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and
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The Outlook

China's Needs

NOW that the Japanese have got Burma into their clutches it is doubtful whether they intend to invade India, but they certainly have undertaken an invasion of China from the west. Hitherto their attacks on that much-suffering country have all come from the east, and Chiang Kai-shek has moved his headquarters westward, step by step, until he reached Chungking, which is a long way distant from Japan and within fairly convenient reach of Burma. While Indo-China was in the hands of an Ally, Burma and Malaya seemed to be safe; but the collapse of France and the policy of Vichy altered all that, and now China is threatened from the west as well, while her main route of supplies has been cut.

A Chinese Government spokesman, when asked what form of help was most needed, replied: "First, fighters and bombers; secondly, fighters and bombers; thirdly, fighters and bombers. After that we will specify our needs."

It is indeed amazing how China has resisted for four years with practically no air weapon at all, but, of course, her sufferings and losses have been very great. The pitiful cry of the Government spokesman may seem to support those who declare that this is "an air war." Actually, it supports the contention of *Flight* (which has received striking confirmation from Sir Arthur Longmore—whose history of the Middle East under his command was published in our last issue) that the air is a necessary arm of an army, and that without a due air component an army is not a well-balanced fighting machine.

How aircraft and other supplies are to be got through to China now that the Japanese have seized Burma is another question, and one that cannot be too easy to answer. The exploit of General James Doolittle, whom we all remember as the winner of the Schneider Contest of 1925, may suggest an answer, but his feat was a surprise, and it is not always possible to repeat surprises in war. Of course, once an American and British battle fleet is able to regain supremacy in the Pacific, all the rest will be straightforward, and all the Japanese tentacles will be cut off from their base to be obliterated more or less at leisure. That time will certainly come, and we all hope that it will not be too long delayed.

The "Prinz Eugen" Torpedoed Again

IF German shipyard workers are familiar with the story of the Odyssey, which is not very likely, the *Prinz Eugen*, and also the *Scharnhorst* and the *Gneisenau*, must remind them of Penelope's web. That ingenious lady used to work at it all day, but at night she unravelled what she had done, and next day started again. So the German workers keep on patching up holes in those three warships, and when they have made some progress the R.A.F. comes along and makes new holes. Repairing them must be heartbreaking work.

The *Prinz Eugen* escaped unharmed from the action when the *Bismarck* was sunk. What she suffered while in Brest we do not know, but she was probably damaged during her escape up the Channel. Then she was torpedoed by the submarine H.M.S. *Trident*, and was lucky to survive. The dockyard workers in Trondhjem patched her up and got her into trim for steaming off to some better-equipped German shipyard, and she actually got down as far as Lister, off the south-west coast of Norway.

Then Coastal Command took a hand, and on the evening of May 12th a mixed force of Beauforts, Hudsons, Beaufighters and fighter Blenheims, numbering over 50 aircraft, fell upon her and her escort.

The Hudsons bombed from a height to make a diversion, but by now it is recognised that the most deadly weapon which aircraft can use against ships is the torpedo. So the chief part in the fight was played by the Beauforts, led by Wing Cdr. M. F. D. Williams, who was, unfortunately, reported missing after the action. The escort of four destroyers was not enough to save the valuable cruiser from damage, for Beaufort pilots are now experts at circumventing an escort and getting home on the main ship. After the first attack the cruiser swung out of the line, thus presenting a good target, and Beaufort after Beaufort, in turn, went in low and dropped its torpedo. Two hits are considered certain, for two explosions were clearly seen on the *Prinz Eugen*, and another hit is considered probable. One pilot believed that he saw several other torpedoes running well towards the ship. The dockyard workers will certainly have more repairs to carry out.

The part played by the Coastal fighters was most gallant. Beaufighters and Blenheims are long-range fighters, and they had to meet an "umbrella" of shore-based fighters, which must always be considered superior. The Beaufighters had the task of raking the decks of the enemy ships, and so keeping down the volume of A.A. fire, and they and the Blenheims gave what protection was possible to the Beauforts. Only one of our fighters was lost. In the circumstances it is hardly surprising that we lost nine aircraft, while it is extremely creditable that our fighters were able to shoot down five of the German aircraft besides damaging others. Altogether, it was an operation which does the utmost credit to Coastal Command.

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PRINZ EUGEN ATTACK

A Bristol Beaufort torpedo-bomber crew putting on their flying kit and flotation jackets before taking off for Norway. Fifty machines took part in the attack.

War in the Air

The "Prinz Eugen" Affair : Russian Air Superiority : Bombing the Japanese

THE torpedo attack by Coastal Command on the cruiser *Prinz Eugen* was a very gallant affair in which the air-borne torpedo again proved its worth. It is, however, a pity that we have not developed machines which can carry a heavier torpedo, for capital ships or large cruisers are seldom sunk by the torpedoes discharged from our aircraft. They have been extremely useful in slowing up enemy ships which were trying to escape, especially the *Bismarck*, which was hit in her screws or rudder, and also during fights in the Mediterranean. The larger torpedoes discharged by submarines or surface craft do not always sink their quarry, and the *Prinz Eugen* has already survived a torpedo fired by a British submarine, but on the other hand many ships have been sunk by naval torpedoes, and the chances of scoring a complete success are naturally better when the weapon used is as powerful as possible.

The Russian Advance

MARSHAL TIMOSHENKO'S advance in the Kharkov area may have very great results, though the German success in the Crimea takes some of the gilt off the gingerbread. Reports from Russia continue to support the claim that the Russians now hold air superiority along most of the front, at any rate at the vital points. It is also reported that the Germans are now short of artillery in many sectors, and that is also a serious matter for them. Though artillery cannot do what aircraft can accomplish, it is equally true that the latter cannot take the place of guns except in very special conditions. It is a sound principle of modern war that when the guns can deal with a situation the aircraft (apart from the spotters) will do more useful work elsewhere. One case has been reported in which co-operation between Russian aircraft and cavalry drove the Germans and Rumanians back from a river which they were holding. The Russian airmen seem well versed in working with their ground troops, and they have concentrated on that class of work, leaving strategic bombing to the Royal Air Force of Britain.

Hitting the Japanese

GENERAL JAMES DOOLITTLE, who led the American Army contingent which recently bombed Japan, has said that one salvo of bombs made a direct hit on a new cruiser or battleship under construction. Nobody knows what Japanese naval construc-

PACKING UP : Balloon crews pack their kit bags prior to a trip down the Channel. R.A.F. Balloon Command co-operate with the Royal Navy in escorting shipping round our coasts. R.A.F. personnel work in the balloon ships, and this additional guard has been found effective against dive bombing.

PACIFIC WAR : A Douglas Devastator over Wake Island, which is now held by the Japanese. The Devastator is a carrier-borne torpedo-bomber carrying a crew of three. For storage on board ship the outer panels of the wings fold upward.

WAR IN THE AIR

tion has been in the last few years, but recently she must have been very short of the necessary raw materials, and it will take some time before her acquisitions in the East Indies will make that shortage good. Therefore, any interference with her present building is very useful work, especially as her loss in cruisers since she joined in the war has been considerable. In any case Japan can never hope to rival the building powers of British and American dockyards, and it is absolutely certain that in due course the command of the Pacific Ocean will again be seized by the United Nations.

India's Defence

THE most imminent threat to India is air attack, though the Japanese may decide to invade also by sea or by land. General Wavell has toured the eastern coasts of India and inspected the defences, and no doubt his visit brought encouragement to fighting men and civilians alike, for his reputation stands high. Madras and Calcutta are the two places which would naturally seem most tempting to the Japanese, for each is a hive of industry, and each has crowded quarters in which the poorer Indians live—commonly, though incorrectly, called bazaars. Neither the Tamils of Madras nor the Bengalis of Calcutta are martial races, and there must be some anxiety as to how they would stand up to a Japanese "blitz."

At present India, like Australia, is indulging in defence by bombing. The American heavy bombers in India are regularly raiding the port of Rangoon and various places in Burma where enemy aircraft are congregated. Particular care is taken not to do unnecessary damage to the city of Rangoon. The Americans report that they have met enemy night fighters, but as a rule they keep well out of range. Sometimes they open fire from such a distance that they have very little chance of hitting the large American bombers. The Japanese A.A. guns at Rangoon also seem to be particularly bad shots.

Although the middle of May is about the hottest time of the year in India, the Americans are bearing it well, and the number of men in hospital was recently only one per cent. The south-west monsoon is due to start early in June, and that is likely to slow down air operations.

The R.A.F. is also playing its part, though the reports do not mention that it has heavy bombers at its disposal. Medium bombers, doubtless Blenheims, have been harrying the airfield at Akyab, and striking sharp blows at the Japanese boats which bring troops up the rivers. This helps General Alexander's army to get clear of enemy pressure as it makes its orderly retreat to the north. That army's gallant stand and rearguard fighting have given General Wavell invaluable time in which to get the defences of India ready, but the troops have had a terrible ordeal.

Malta has now brought down over 100 Axis aircraft since the first of May, and as the attacks grow weaker the defences take heavier toll. The arrival of Spitfires on the island seems to have made a considerable difference to the strength of the defences, for the latest Spitfire is the finest fighter of the day.

AMMUNITION FOR GUERILLAS: Wooden containers employed by the Russians for dropping supplies by parachute.

LOOKING FOR TROUBLE: A Ju 88 over the Grand Harbour, Valetta, Malta.

The Northern Front

THE period of "Baedeker" raids on British cathedral cities has ended for the time being, and the Germans have ventured on expeditions against Hull, in which they did some damage and caused some casualties. That is in accord with their recent policy of sticking to coast towns, which gives them the advantage of tip-and-run tactics; but Hull is a good deal farther from their bases than any of the cathedral cities were, and that meant a longer return flight across the sea and less chance of damaged machines reaching their bases. Still, it is obvious that the *Luftwaffe* is now

WAR IN THE AIR

stretched to the limits of its powers, and its chiefs must be carefully reckoning what losses they can afford on any one raid.

The R.A.F. continues to take advantage of any favourable weather, which means considering what conditions are over the target, and not merely judging by fine weather in Great Britain. One recent raid by Bomber Command went to Mannheim, an important centre of German war industries, while the submarine base at St. Nazaire and other nearer objectives get more frequent visits.

Few towns in Germany are of more importance now to the enemy's armed forces, and especially to the German Army, than Mannheim. The raid on it was made by a great force of Stirlings, Halifaxes, Lancasters, Manchesters, Wellingtons and Hampdens. From the centre of the town to the surrounding suburbs there are war factories of all kinds, making tanks and motor vehicles, diesel engines, explosives, and a great variety of other armaments. Mannheim is the second largest inland port in Europe. Its docks receive a continual supply of raw materials, tank bodies, armour plating and so forth, which come down the Rhine from the Ruhr. The concentration of industrial plants in Mannheim is as close as anywhere in Germany.

Our bombers carried a great load of incendiaries and the heaviest high-explosive bombs. One detachment of Stirlings carried over 40,000 incendiary bombs. Mannheim was identified from the bend in the River Rhine, and, without a cloud in the sky, the docks were easily seen.

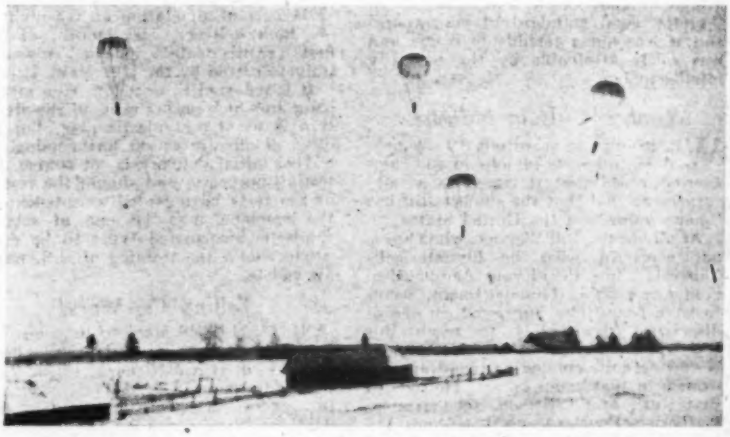
Reports of crews give an encouraging description of fires burning and of heavy high-explosives bursting among industrial buildings.

Fighter Command carries on with daylight sweeps, which do not imply such careful meteorological calculations, and they usually escort formations of Boston bombers or Hurricane bombers to wreck military targets within range of the Spitfires. The policy of the German fighters in France now seems to be to attack our machines as they start for home, when they may not have enough fuel to allow them to undertake prolonged engagements.

IT'S IN THE AIR : A flying picture of the new Merlin-engined Curtiss Warhawk. This is the first photograph of the Warhawk to pass censor indicating the number of guns carried in each wing. The extra fuel tank for long-range work is also interesting. Details of the Warhawk appeared in our issue of May 14th.

BACK FROM NORWAY : Beaufort crews being interrogated after returning from the torpedo attack on the Prinz Eugen.

IN the June number of our associated technical journal AIRCRAFT PRODUCTION published this week, the main feature is Part I of a detailed study of the production processes of the Handley Page Halifax bomber, while other production articles deal with the Rubery Owen Messier undercarriage, manufacturing phases of the U.S.A. Boeing B17E (Fortress II) bomber, the Curtiss-Wright Condor III troop carrier, and the employment of automobile manufacturing methods in the production of Franklin air-cooled aircraft engines. Other factory technique treated includes Form Grinding and Relieving, Flame Hardening, the Inspection of Light Castings, Tool Salvage, an unusual method of plastic-bonded construction for trainer aircraft, and notably, an article on Thread Grinding and the diamond tools and crushing equipment for form-dressing wheels. Finally might be mentioned the leading articles, one stressing the value of liaison between operational, design and production personnel in the evolution of perfected aircraft types, and two on the wartime fuel economy controversy.



OUT IN THE COLD, COLD SNOW : Supplies being dropped by parachute to isolated German units on the Russian front. The enemy have made a special feature of supplying and reinforcing their armies by air.

HERE AND THERE

U.S. Consul for Foynes

MR. WILLARD CALDER, U.S. Vice-Consul at Belfast, has recently been appointed Consul at Foynes, County Limerick.

Foynes has not hitherto boasted an American Consul, but the increasing importance of the town on the trans-Atlantic air route has caused the U.S. State Department to open a consulate there.

A Stranger in These Parts!

IN the April issue of *Contact*, the journal of David Brown and Sons, Ltd. (there have been other journals by the self-same name), there are a number of jokes under the heading of "Jottings from the Journals," which includes one from the "Xmas Interlude" pages of *Flight*, December 25th, 1941, and the following one which you may not have heard before.

"Can you tell me the way to the police station, please?" said the nun, going up to the priest in the street.

"Sorry. No good asking me. I'm a paratroop, too."

Wise Words to the A.T.C.

WHEN Wing Commander J. A. Cecil Wright, M.P., Regional Commandant, Midland Region, A.T.C., recently opened the new recreation rooms of No. 165 (Fort Dunlop) Squadron, he impressed on them the value of the training they were receiving, even if the war ended before they reached their goal in the ranks of the R.A.F.

It would be invaluable to them, he said, in the work of reconstruction after the war, a task in which the youth of the country would be urgently needed.

The R.A.F., he told them, demanded a high standard of physical fitness and a "pretty good standard of education." But it was not a terribly high one and was easily attainable by the normally intelligent boy.

Yankee Girls in Industry

WE are now so accustomed to women doing all sorts of jobs in the engineering world that it comes as a mild surprise to find that the subject still has "news value" in the United States.

At all events, Bill Wagner, who churns out acres of what he himself calls "drivel" for the Ryan Aeronautical Company's publicity department, seems to have been quite impressed, in one of his latest news-sheets to reach this country, by the fact that his company is now actually employing two draughts-women in the design office. He tells us that Ruth Ann Pederson, aged 21, and Katherine Ponsford, aged 19, are the new phenomena, but to us in Britain the only new aspect of this announcement was that Wagner spells it "drafts-women."

TAKEN FOR A RIDE: Nothing is left unrehearsed when training the American forces, as this official photograph of the U.S. Army Signal Corps shows. The little car is known as a "peep" (or is it a "jeep"?)—anyway, the picture provides a peep at a peep (or a jeep) being loaded into a "mock-up" air transport; note the ingenious door-cum-ramp arrangement.

Synthetic Altitude

CANADA has just bought 12 more stratosphere chambers, which brings her total of these "cold rooms" up to 18 throughout the country. They have cost £1,400 each and are being used in connection with the Commonwealth Air Training Plan to accustom aircrew trainees to high-altitude conditions.

The type now being used is divided into three compartments, the first for temperatures down to zero, the second from zero to −20 degrees F., and the third from −20 degrees down to −70 degrees F. Corresponding decreases in atmospheric pressure to reproduce conditions at various altitudes are also effected.

U.S. Plastic Trainers

THE naval air station at Washington took delivery, last month, of the first experimental plastic plywood trainer ordered by the U.S. Navy Dept.

It is reported to be a low-wing monoplane in which 90 per cent. of the structure is wood and plastic glue, but no other details are as yet forthcoming.

This initial delivery is, of course, for testing purposes, and should the results of the tests be regarded as satisfactory the machine may be one of several similarly constructed types to be mass produced for the training of U.S. naval air cadets.

Telling the World

AUSTRALIANS seem to be somewhat dissatisfied with their own official handling of R.A.A.F. news, to judge by editorial comment in *Aircraft*, which is the oldest aviation journal in the Southern Hemisphere.

This journal says that, although individuals with aviation contacts know of the grand work the pilots and aircrews of the R.A.A.F. have been doing over a wide area, the public is told so little in the officially issued news that it thinks Australia's airmen are playing rather a feeble part.

There is also some indication, it says, that the R.A.F. habit of suppressing the names of officers and men in news items is being copied by the R.A.A.F., but that "most people are heartily sick of the constant use of Ministers' names attached to the slightest piece of news."

Well-told stories of their airmen's gallant fights, giving names, would, it adds, be the finest possible tonic for public morale.

Maybe they've got something there!

Veteran Squadron

ONE of the oldest squadrons of the Royal Air Force, a pioneer of the Imperial Mail route to India and long-distance flights over Africa, is still on active service after 23 years in the Middle East Command.

Now engaged on transport and communication duties, this unit, which was formed in 1917 as a R.N.A.S. squadron, carried out night bombing operations in the Great War. It was, in fact, one of the first squadrons selected to bomb Berlin, although the Armistice prevented these raids from materialising.

Transferred to the R.A.F. in January, 1918, the squadron went to Egypt the following year and has been in the Middle East ever since.

Death of Marjory Spiller

WE regret to record the death, at Sevenoaks, after an illness, of Marjory Spiller, who was chief instructor to the Eastbourne Flying Club before the outbreak of war, and afterwards joined the women's section of the A.T.A.

She learnt to fly at Shoreham in 1935 as a member of the South Coast Flying Club and gained an instructor's endorsement to her "B" licence in 1938.

AIR SUPPORT IN BATTLE

The Air Arm and the Ground Forces : The Development of Tactics : The Experience of Past Campaigns : Methods of Employment

THE far reaching specialisation of weapons is an established and most outstanding feature of mechanised warfare. But in air warfare technical specialisation is even more clearly defined than on the ground. The necessities of combat and the limitation imposed upon the designer by the laws of nature have resulted in a rigid specialisation of aircraft types, each devoted to singular specific employment in combat.

But while many seem to imagine that salvation lies in some particular type of aircraft, no single weapon can ensure that absolute ascendancy which is wanted. It is only a well-balanced range of war tools and their *skilful and harmonious* employment which can bring the desired superiority in combat whether on land, sea or in the air.

This sounds to-day like an axiomatic truth. And yet it is still necessary to emphasise that this is the *conditio sine qua non* of modern operations.

The Rôle of the Air Arm

Whether it is in the interest of economy to indulge in such variety of types is another matter. Important as economic considerations may appear to be, they cannot or should not be overriding. The concentration of the industry on the production of a few types is certainly not the only sound basis, provided that among the selected few are types of aircraft which are of paramount importance in modern battles. For since it is established that in a modern battle the close co-ordination and co-operation of the ground and air forces is essential, the suitable equipment of such air units is the only possible logical imperative.

The dive bomber was and still is the weapon with which the Germans and recently the Japanese have achieved their major successes. But if we study the problem a little closer, we must acknowledge the fact that it was primarily the tactics developed by the German forces to which these successes have to be attributed. Russian strategy first recognised the immense value of the interference of the air arm in combat with the ground forces.

This conception did not limit the task of the air arm to reconnaissance or long-range bombing. It involved an active and constant participation of the air arm in the ground combat as an integral part of the equipment and tactical dispositions of the ground forces. For inasmuch as mechanisation has given the infantry improved manœuvrability and high mobility, the mobile tactics of modern warfare call for a weapon which can strike deep into the defences of the enemy, which is fast and quick-hitting and which extends the range of the fire power of the tank.

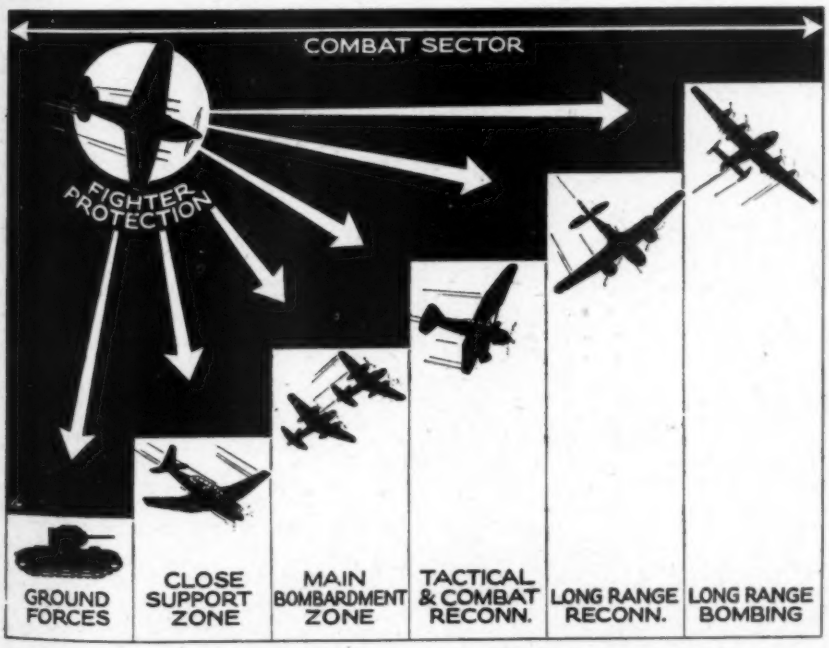
Such weapon is evidently the airborne artillery, replacing the divisional artillery of the 1914 war of positions. The debut of this tactical employment of aircraft was made on March 27th, 1937. On this day an Italian motorised division which had advanced some 25 miles in four days accompanied by tanks was surprised by some 115 Russian aircraft, in particular the I-15 and I-16, and the effect of some 55,000 lb. of bombs dropped and 200,000 rounds of ammunition fired was the dispersal of the division.

The German Way

From this display of Russian tactics in the Spanish laboratory, the Germans were quick to learn. Their "Panzer" divisions have been equipped with air units, which are an *organic part of each division*. Although they form a part of the *Luftwaffe*, these air units are not attached but belong to the "Panzer" divisions and in case of necessity are further reinforced from the *Luftwaffe* air divisions operating in the area. In other words, the commander of ground operations has *always* at his disposal air units just as he has signals, tanks, ordnance, etc.

This is quite in harmony with the Encyclopædia of German Military Knowledge (the "Handbuch der Neuzeitlichen Militäerwissenschaften") which defines the tactical employment of the dive-bomber (the Stuka, an abbreviation for Sturzkampfflugzeug) as follows:—

"The Stuka is employed against small but very important and very vulnerable objectives. In a battle, the air arm is used as a method of attack applied exclusively to the combat on the ground. Its purpose is tactical intervention from the air in ground combat. The objectives of such attacks are both fixed and moving and situated within or immediately behind the zone of combat. Possible advanced objectives to be attacked *simultaneously* with the infantry assault are centres of resistance, artillery positions and all kinds of



Air arm in the ground battle : The diagram shows the different tactical zones of operation.

AIR SUPPORT IN BATTLE

columns on the march, especially in confined places and during crossings when in retreat."

In the Russo-Finnish war, the Soviet Air Arm played a vital role as a battle force in close support of the operations of the ground forces. The main weight of the air forces was thrown against strong points and the vital defences of the enemy, and its striking power effectively supported the army in breaking the Mannerheim Line. The close interweaving of ground and air operations, much as it has become known as a German chef-d'œuvre, has thus been established for quite a considerable time in Russian tactics. No doubt the Germans have brought this method to perfection and have used it extensively in all operations. In the Stuka these close support tactics found a valuable and serviceable instrument.

The Importance of the Stukas

In the Polish campaign they used the Stukas extensively in attacks on retreating Polish armies when any such movement was carried on on the highways of Poland. There is no doubt that this carefully preconceived bombing of communication lines was largely instrumental in rendering ineffective the mobilisation plans of Poland. This was quite according to the definitions laid down in the above quoted handbook for the employment of the Stukas and was later repeated in France, Norway, Belgium and in Russia.

Indeed in France, the air arm formed the vanguard of the attack, forging the way for the fast divisions, while at the same time guarding their flanks against such counter-attacks on the tank column which the enemy might have launched from a greater distance. In the piercing of French defence positions on the Meuse, the concerted attack of some 650 Stukas was largely responsible.

Yet in all these campaigns there is one common denominator: the lack or weakness of air opposition which permitted the Germans that wide employment of their Stukas. For the Stuka has neither the speed, the manœuvrability nor the fire power to withstand the onslaught of a fighter. To be effective, it must be used in *mass employment* and to be able to do so the air superiority over the battle area must be first established. In all campaigns where the Stuka scored such brilliant records the opposition had inadequate air forces, not only to establish an air ascendancy but to put up an efficient and lasting opposition. Where such air superiority was established, the Stukas met with a sad end.

This is in itself not a denial of the value of the dive-bomber as a specialised weapon for employment on specific tasks; however, in learning the lesson from the battles of Europe one should be careful in sorting out the relevant from the irrelevant, the general from the specifically local. No doubt a great share of the Stuka's initial success was due to psychological factors. To the unaccustomed, noise and incessant bombing was at least as nerve-racking as it was physically dangerous. The sensation of helplessness breeds nothing short of chaos. In the words of a German military writer, Stuka attacks are to "stifle all enemy attempts to organise his defences, and to *grind quickly the physical and moral resistance of his troops.*"

On the Russian Front

On the Russian front the operations of the air arm supporting light or heavy armoured forces came into special prominence. Oberstlieutenant der Flieger Gehrts, describing the activities of the *Luftwaffe* in the initial phases of the Russian campaign, says: "Special mention should be made of the 'Schlachtgeschwader' (Battle Squadrons), these specially equipped units for the co-operation between the Air Forces and the army; they are primarily entrusted with the *task of breaking the way for the ground forces through the defences of the enemy* with their board weapons and light bombs *where the help of the artillery does not reach. In many sectors the break through enemy defences was primarily due to the employment of the 'Battle Squadrons.'*"

On the other hand, communiqués from the Russian front constantly indicate the successes of the efficient employment of the Soviet Air Force against the German ground forces. It would be too tedious to quote here the long list of such engagements in which Soviet air units effectively interfered in the ground combat, but a typical example is the communiqué on March 4th, reporting the destruction of 370 German lorries loaded with troops, cartridges, fuel lorries, and the dispersal of two battalions of German infantry by Soviet aircraft.

Thus it is for the first time that both combatants employ fundamentally the same tactics, and it is interesting to note that both of them are able to ascribe to the air arm an ever-increasing share in their ground combats. It is also significant that the Germans do not reserve for their Stukas exclusive monopoly in the ground battle. While the tactical employment of the aircraft in ground battle remains the same, it is clear that the units so employed are not only Stuka squadrons but formations of heavily armed fighters.

For the scale of interference of the Air Arm in the combat of ground forces is to-day so wide that specialised aircraft types are allocated for different operational tasks. In modern battle, air units operate throughout the sector of combat and beyond. This is shown diagrammatically in the accompanying picture. For each zone of operations different tactics and different weapons are necessary, and to miss one of them would be to create a dangerous gap and to court disaster.

The Need for Co-ordination

While the employment of aircraft for reconnaissance purposes is already an established tradition, the wider and active use of air units in the battle is, however, relatively new. But experience gained in different theatres of war, described in the preceding paragraphs, renders definite proof of the value of the Air Arm in ground fighting. In the same measure as modern armies are equipped with a variety of guns, artillery mortars, etc., the three-dimensional conception of combat must be put into practice. For this purpose we must, to quote a recent statement of the Member for Kettering, "Cease to regard the Army and the R.A.F. as different species of individual, as independent entities; we must look upon these two sister Services as complementary and inter-dependent components of a perfectly co-ordinated precision machine."

Such is the correct conception of the relationship between the Air Arm and the ground forces. From this conception arise new tactical requirements of combat which necessitate different types of aircraft in ground battle, which will be the subject of another study.

"Wasp" Engines Only for the T.C.A.

FOLLOWING the policy laid down by the Dominion Government calling for standardisation of equipment as far as possible, Trans-Canada Air Lines have embarked on a programme of uniformity in aircraft engines, according to an announcement by O. T. Larson, vice-president. Work has already been started on installing twin-row Wasp engines in all of their Lockheed 14s, which will give these commercial transports an even better performance.

Test flights have been flown on the first of the twelve machines in which the greater power has been installed, and expert test crews report satisfactory results from every angle. The entire change-over programme has been directed by T.C.A. staff, and is a further example of the daily contribution to Canada's war effort by company personnel.

Completion of this work will standardise the power in all T.C.A. aircraft which will result in operating economies and a reduction in spare parts requirements, thereby easing the pressure on engine manufacturers.

BOOK REVIEWS

Winged Victory. By Ariel. Blackwell, 2s. 6d.

THIS is a collection of 32 poems by a flight lieutenant, and those who have a taste for poetry will find much to please them. Not all of it is in serious vein and there is one delightful dig at Goebbelsian inconsistency in pleading for so many rescue ships to pick up the triflingly few pilots they ever admit losing in the English Channel. Glancing through the pages one drops here and there upon many changes of mood—the gentle, the solicitous, the reminiscent and the vigorously warlike. It may not be genius but it is all satisfying.

Ark Royal, the Story of a Famous Ship. By Sir Herbert Russell, K.B.E., in collaboration with Commander H. Pursey, R.N. (John Lane, The Bodley Head, 4s. 6d. net.)

A SHORT book of only 92 pages, this is one of the most fascinating publications about the war which has yet appeared. The aircraft carrier, *Ark Royal*, the third vessel of that name to serve the Crown, had but a brief career, but it was full of adventure and success. Being the first of a new class of carrier, she was much photographed and described in the Press before the war, and so the British public became familiar with her name and took almost a personal interest in her doings. She was, perhaps, the most popular ship in the Royal Navy.

The public did not always know where the *Ark Royal* was or what she was doing, and therefore it was well worth the while of Sir Herbert Russell and his collaborator to write this brief consecutive history. Needless to say it is well written, and the book includes four excellent photographs, showing how a carrier can be impressive from her mere size, though she can hardly claim grace or beauty. The book is sure to receive a warm welcome from the reading public.

Canada's Wings. By Peter J. Field (John Lane, The Bodley Head, 4s. net).

RATHER a slight book, which touches sketchily on the history of the Royal Canadian Air Force, and then goes on to recount instances of good air work by Canadians in the present war. The author's attention is, quite rightly, divided between the R.C.A.F. squadrons and the doings of Canadian airmen in R.A.F. squadrons. It appears that the doings of fighter pilots have a particular attraction for the author, though bombers and others are not neglected. Some account is given of the great Empire Training Scheme in Canada, but, again, the treatment is sketchy. One chapter tries to do justice to the ground crews—and they deserve far more praise than they have ever received. Perhaps the most interesting chapter deals with the work of the Eastern Coastal Command of the R.C.A.F., which corresponds to the R.A.F. Coastal Command. In this Command a number of the pilots are experienced men from the air lines, and one of them remarked: "I thought I was hot when I came here, yet I had to learn everything. For instance, I had no wireless beam to help me. I had to fly in storms and at night. I was over grey water all the time. I was like a little kid, completely lost for weeks. This is the hardest job in flying I have ever attempted."

How to Pilot an Aeroplane. By Capt. Norman Macmillan, M.C., A.F.C. George Allen and Unwin, 2s. 6d.

CAPT. MACMILLAN is probably unique among really experienced pilots for the number of books he has written on almost all aspects of flying. With thousands of hours experience in the air, in war and peace, as an instructor and as a test pilot, no man is better qualified to write on the gentle art of piloting than he—and many are nothing like so well qualified. Moreover he is an author of experience, too, and this latest addition to the range of Air Cadets handbooks is one in which every embryo pilot can place complete trust.

While obviously nobody can become a pilot without practical instruction in the air, it is nevertheless equally true that to acquire a really thorough knowledge of how and why the controls of an aircraft function, and how they should be handled, will give to any pupil pilot a "flying start" when he steps into the cockpit of a trainer for the first time. In this 110-page book, nicely illustrated with photographs, the reader will find all he needs to *know* to become a pilot; all that remains will be for him to acquire the knack of putting it into practice. Aerobatics and advanced flying are also included in its range.

Two Books on Aircraft Engines—Aero-Engine Theory Simply Explained, and Aero-Engine Practice Simply Explained. By Group Capt. Coats. Pitman's, 6d. each.

THESE two little books, each comprising some 40 pages well illustrated by diagrams and sketches, should be read in the above order since the first one starts from scratch and assumes no previous knowledge whatever of the internal combustion engine. In the simplest possible language, the author, a qualified expert on his subject, explains what an aircraft is and how it works; in the second one he gives a practical picture of the modern aircraft engine (radial and in-line types) and describes its component parts and their functions, and winds up with some general notes on maintenance, overhaul, testing and the diagnosis of faults. Both books are extremely well written and although both are intended for the beginner, there will no doubt be many "experts" who will be able to pick up a thing or two from their pages.

Aerobatics Simply Explained. By Wing Cdr. R. Cravell. Pitman's, 6d.

STRESSING in his introduction the value of properly studied and intelligently executed aerobatics in the training of a pilot, the author is patently writing for those who can already fly in a normal manner. That is to say, he does not take the reader through the business of taxying, taking-off, climbing, turning, gliding and landing, but proceeds straight into aerobatics from the simple dive and pull out, via loops, spins, rolls and so on to inverted turns and finally the inverted spin.

This being so, it seems somewhat unnecessary to have explained and illustrated the three axes of an aircraft, the looping, yawing and rolling planes and the effect on the aircraft's movements of rudder, elevators and ailerons; surely any student ready to embark upon aerobatics will have learnt all that elementary business long ago.

However, once the book gets down to the actual job in hand it does it thoroughly, concisely and clearly, and the author does not forget to warn the reader of the stresses involved in certain manœuvres and how careful handling of the controls in all manœuvres will avoid imposing unnecessary loads on the structure of the aircraft—an important point which the learner might otherwise overlook in his enthusiasm.

Four More Books on Navigation and Meteorology—Air Navigation for Beginners. By A. W. Siddons. Edward Arnold and Co., 1s. Examples and Exercises in Elementary Air Navigation. By M. J. Hearley, B.Sc. Longmans, 1s. Navigation and Meteorology. By D. Hay Surgeoner. Longmans, 3s. 6d., and Elementary Meteorology for Aviators, Part I. Longmans, 1s.

A SHORT time ago *Flight* reviewed a trio of new books on navigation and commented upon the fact that there seemed to be quite a spate of publications on this subject. But still they come, the third on the above list devoting 94 pages to navigation and only the final twelve to the subject of meteorology.

It would be mere repetition to go over the subject matter of these useful, if somewhat prolific, little volumes; the only real difference between any of them and any of their predecessors is the angle of approach and manner of treatment, since of necessity they all cover more or less the same ground, most of them beginning by reminding the reader that the Earth is not quite round, but that he needn't bother about this little discrepancy. Of the present batch, Mr. Hearley's work is an exception because it begins where the A.T.C. and I.T.W. syllabus leaves off—more or less—and sets out to provide the necessary practice to promote accuracy in the basic navigational calculations.

The last-mentioned of the four books above bears no author's name but is "designed to cover the A.T.C. and I.T.W. syllabus." Stressing the importance of meteorology to the airman, it should give the reader a clear grasp of the atmosphere with its variables—pressure, temperature, wind and humidity—and some of the instruments used to measure them. Naturally such a small volume can only cover the elementary outlines of such a big subject, but it will provide a sound basis for future training. It contains a series of very good photographs of typical cloud formations which the student should learn to recognise as he does different types of aircraft.

TRANS-AFRICAN AIR SERVICES

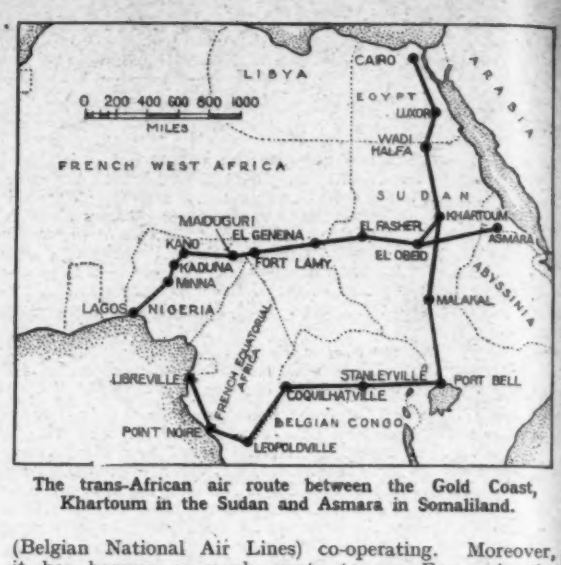
Spur Line which has Become Vital Allied Air Route : Nine Weekly Services Between Gold Coast and Sudan : Converted Whitleys Augment B.O.A. Air Fleet

BEFORE the war there was an important spur line to the Empire air route across Africa. It was a landplane service from Khartoum to West Africa via El Obeid, El Fasher, El Geneina, Fort Lamy, Maiduguri, Kano, Kaduna, Minna and Lagos. From the last-named airport in Nigeria, Elders Colonial Airways, an associate company of Imperial Airways, operated to Accra and Takoradi.

This feeder service, once weekly each way, was operated with Diana (De Havilland 86) aircraft, capable of carrying six passengers.

Until the summer of 1940, the trans-African route remained what it has been since its inception in February, 1936, a spur line from the main Empire flying-boat route between the United Kingdom and Durban. But with the closing of the Mediterranean to British civil aircraft due to Italy's entry into the war, the trans-African route assumed a much more important position. Now it is a main route of British Overseas Airways, with Sabena (Belgian National Air Lines) co-operating. Moreover, it has become a supply route to our Forces in the Middle East, in which Pan-American Airways also play a part.

Two views of British Overseas Airways' rest house at Lagos on the Gold Coast. The exterior is shown in the top photograph and below is a glimpse of the restaurant.



The trans-African air route between the Gold Coast, Khartoum in the Sudan and Asmara in Somaliland.

In August, 1940, British Airways flying-boats opened a regular service between England and West Africa. This and the route across Central Africa then became the main artery from the United Kingdom to the Empire route which operates between Durban, through Egypt and Iraq, to India, and—at that time—to Singapore and Australia and New Zealand.

Ensigns in Service

At present, nine services per week each way operate between Takoradi on the Gold Coast and Khartoum, in the Anglo-Egyptian Sudan. They are both Pan-American and British Airways, three of the latter's services going beyond Khartoum eastward, including one by "Ensign" aircraft from Lagos to Asmara. The trans-African lines are in general along the old Imperial Airways routes, and the old stopping places are seeing more and more aircraft, although most of them carry mainly military and R.A.F. personnel and equipment. Such picturesque spots as Kano, Fort Lamy, El Geneina and El Fasher are on this route. At most of them passengers are accommodated, when there is an overnight stop, in rest-houses specially built and equipped for European travellers in these tropical regions.

The trans-African landplane services, both British Airways and Pan-American, are in the main operated with Lockheed 14s and Lockheed Lodestars, D.C.3s and D.H.95s. B.O.A. has recently acquired 12 Armstrong-Whitworth Whitleys, which are being converted and registered as civil aircraft, and it is possible that these, or some of them, may be used on the trans-African service as freight-carriers. Sabena, whose services are twice weekly in each direction between Takoradi and Khartoum (once weekly to Cairo) via Stanleyville, use Junkers Ju 52s and Lockheed 14s.

On the flying-boat route across Africa, British Airways use Empire flying-boats. The service operates once weekly in each direction, Lagos to Libreville, Pointe Noire, Leopoldville, Coquilhatville, Stanleyville, Butiaba, Port Bell, Juba, Malakal, Khartoum, Wadi Halfa, Luxor and Cairo.

Thus West, Central and East Africa are linked with England, the Cape and India. There are other routes which for the time being must remain secret.

Incidentally, passengers on the trans-Africa route are handed, among other reading matter, a few notes briefly outlining the history of the service since it was pioneered and developed by Imperial Airways in 1936.

A notable development came in 1941 when the British Government granted special operating rights to Pan-American Airways.

WORLD PRESS SUMMARY

RÉSUMÉ OF TECHNICAL ARTICLES DEALING WITH AIRCRAFT AND ASSOCIATED SUBJECTS

For the summaries and translations from aircraft and technical journals of the world, we are indebted to the Directorate of Scientific Research and Technical Development, Ministry of Aircraft Production.

A.A. Fire Control

THE accuracy of A.A. fire depends primarily on the correct estimation of the distance of the target. For this purpose, stereoscopic range-finders are usually employed, which, unfortunately, depend markedly on the keenness of stereoscopic vision of the observer. In order to weed out unsuitable personnel at the earliest possible stage of training, the author describes an automatic device (the verograph), operating on the theodolite principle, which records the true distance of a moving target, provided the latter is kept in the field of view of the telescopes.

The distances estimated with the stereoscopic range-finder are transmitted to the verograph, and the pupil will thus see a graphical record of his errors at various distances.

The Verograph—a new training device for A.A. fire control. (*Flugwehr und Technik.*) (Switzerland.)

Celestial Navigation

AN instrument is described in which a pair of mirrors and a prism deflect the light of two particular stars into a telescope in such a manner that, when the images of the two are seen super-imposed in the centre of the field of view, the telescope axis must be pointing directly at the celestial pole. The angular elevation of the telescope is then equivalent to the latitude, and the rotational position of the mirror combination about the telescope axis shows the sidereal time. The direction of gravity may be indicated either by a bubble cell or by a pendulum stabilised in some manner. A preliminary model, making use of a bubble, has given a probable error of one setting of about O°.1 in both latitude and longitude, successive readings being separated by less than two minutes of time.

A New Instrument for Celestial Navigation. (N. W. Storer, *J. Aeron. Sci.*) (U.S.A.)

Windscreen De-icing

FOR some time various American airlines have been experimenting with devices to keep the windscreen of commercial transport aircraft free from ice. Tests have been conducted by American Airlines Inc. with rotary and return-stroke type windscreen wipers which in conjunction with de-icer fluids promised satisfactory results. United Air Lines, on the other hand, conducted tests which, meanwhile, have induced the company to turn down the idea of moving windscreen wipers. The line in question is now equipping its aircraft with double windscreen panes, the front pane consisting of safety glass ¼in. thick, and the rear pane of a transparent plastic ¼in. thick, with a ¼in. air space between the two. For the heating of the air space between the two panes, hot air of a temperature of 175 deg. F. is conducted from the cabin heating system to the panes and leaves through an exhaust duct leading to the outside. The experiences so far gathered by United Air Lines with this type of ice-free windscreen are stated to have shown better results than have been obtained with mechanical windscreen wipers and de-icer fluids.

Windscreen De-icing. (*Inter Avia.*) (U.S.A.)

Anti-tank Armament

IN order to obtain a satisfactory firing accuracy in aerial fighting, the distance of attack must be as small as possible, as a result of which the projectile with a high muzzle velocity hits the opposing aircraft's armour with a force differing only little from its energy upon leaving the barrel. In contrast, the distance of attack by aircraft on tanks can be increased from 500m. to 1,000m. (550yd. to 1,100yd.) without material effect on the firing accuracy. Not only is the aircraft forced to maintain a greater distance of attack by the ground defences, but a minimum altitude is required anyway for an attack in a dive. For a given muzzle energy, the projectile with a moderate muzzle velocity loses a much lower percentage of its energy in the course of its trajectory than the projectile with a high muzzle velocity.

Thus, since a moderate muzzle velocity of the projectile is sufficient to meet the requirements of firing accuracy, an additional advantage results as regards the power of penetration: the percentage of the aircraft speed that is added to the muzzle velocity of the projectile increases with decreasing muzzle velocities. A comparison of a 20mm. shell weighing 120 grams (0.264lb.) with a 37mm. shell weighing 760 grams (1.675lb.) which, for a given energy at the muzzle, have a velocity of 900m. and 358m. (2,950ft. and 1,175ft.), respectively, shows that the projectile of small muzzle velocity gains a much greater percentage of energy due to the forward speed of the aircraft. For an aircraft speed of 600 km/hr. (about 375 m.p.h.), the energy increase of the 37mm. shell amounts to 55 per cent. On the other hand, the absolute projectile velocity then amounts to 525m. (about 1,720ft. a second), a value guaranteeing a sufficient measure of firing accuracy for distances of air attack on tanks ranging from 500m. to 1,000yd.

It seems to be clear, therefore, that the fighting conditions between two aircraft or between an aircraft and a tank call for two different weapons in the case of identical muzzle energy of the projectiles employed. If these considerations are taken into account, these differences should purposely be increased: already to-day the 15mm. cannon of the latest version of the Messerschmitt Me 109 fighter and the 37mm. cannon of the Bell Airacobra or the latest Russian fighters are well known.

The Anti-tank Armament of the Fighter Aircraft. (C. Rougeron, *Inter Avia.*) (Switzerland.)

Tricycle Design

THE problems of the tricycle landing gear are discussed in the light of available information with the object of providing criteria to assist the designer. The general geometric arrangement involving the determination of wheelbase, tread, and centre of gravity location is first considered. It is shown that the nose wheel should be located as far forward of the centre of gravity as possible, and the fore and aft location of the rear wheels is limited to a narrow range by conditions of balance and longitudinal stability. The relationship between tread, wheelbase, and the resistance to turning over is found and the effects of tread and fore and aft location of the rear wheels on the directional stability and ground manœuvrability are discussed.

The problems related specifically to the design of the nose wheel are next examined. A basis for the selection of nose wheel and tyre size is given. The fundamental causes of shimmy are reviewed including the effects of trail, caster angle, wheel offset, tyre type, and moment of inertia of castering parts. Shimmy elimination is discussed with special reference to elimination by damping and including methods of calculating the amount of damping necessary to prevent shimmy. The construction of fluid dampers is described and their damping characteristics compared to the simpler mathematically defined types of damping. An empirical relationship between the volume of a vane type hydraulic damper necessary to prevent shimmy and the static nose wheel load is given.

Ground handling and manœuvrability, construction and installation difficulties, castering locks and stops, and steering devices are briefly discussed. Conclusions as to the best arrangements must be based on the characteristics of the particular design. As a partial check on the validity of the criteria developed, the results of applying them to some successful tricycle gear aircraft are summarised.

Tricycle Landing Gear Design. (E. S. Jenkins and A. F. Donovan, *Inst. Aeron. Sci.*) (U.S.A.)

BEHIND THE LINES

Service and Industrial News from the Inside of Axis and Enemy-occupied Countries

From Rumania

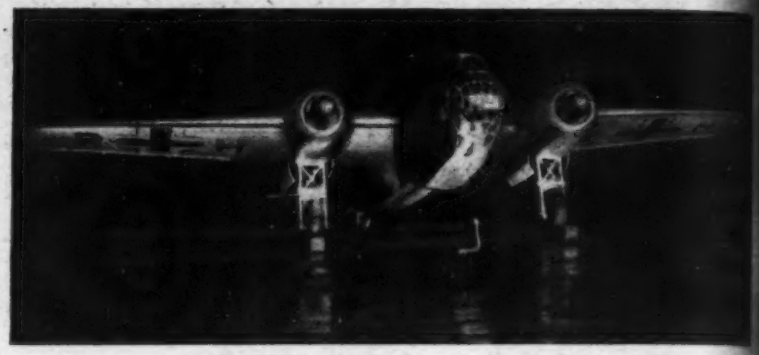
THE report of the activities in 1941 of the State-controlled Rumanian Air Transport Co., "L.A.R.E.S.," is now at hand. The regularity is stated to have been 99.98 per cent., the proportion of seats utilised 66.16 per cent., and the average speed 140 m.p.h. It is interesting to learn that 40 per cent. of the Company's operations have been non-scheduled charter flights.

More on the Do 217

PICTURES of the Do 217 were published in *Flight* of May 21st, and in previous issues (February 12th and March 12th) some details were given of this new addition to the *Luftwaffe's* equipment. Of particular interest is the new lift-increasing device incorporated in the Do 217. This appliance is probably based on the German patent taken out by the Dornier Co., which covers a special design of a split-type flap and of the recess in the underside of the wing housing it. When the flap is actuated a duct is created between the flap and the recess, starting at the underside of the wing, narrowing over the flap's leading edge and gradually widening out towards the wing and flap trailing edges. At the narrowest point of the duct, i.e., opposite the leading edge and the axis of rotation of the split flap, slots open out in the fixed upper wall of the duct; these start in the top surface of the wing and are apparently designed to suck off air from the upper boundary layer into the low-pressure region prevailing in the duct.

Co-operation

REPORTS from Occupied France show that the Germans are tightening their grip on the French aircraft industry. The close collaboration between German and French companies is mainly aimed at the manufacture under licence of German aircraft types.



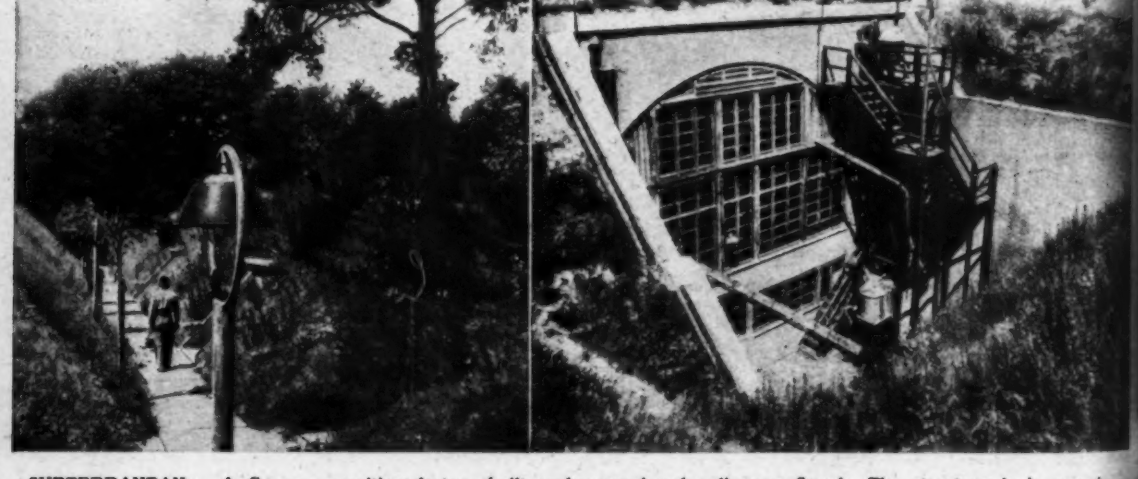
***LUFTWAFFE'S* LATEST: The Dornier Do 217, a "multi-purpose" aircraft which is coming increasingly into service. Some further details appear on this page.**

The Moraine-Saulnier Aircraft Co., of Puteaux, Seine, is now known as the Fieseler-Paris Works and is engaged on the production of the Fieseler Fi 156 "Storch." Whether any further affiliations have taken place is not known, but German contracts have been placed almost with all French firms. Thus the Amiot is building the Junkers Ju 52, while other French factories are producing components for the Ju 87 and Ju 88. In addition, the following German types are now in French production: Siebel Fh 104A twin-engine transport aircraft; the Focke-Wulf Fw 189 short-range reconnaissance aircraft; the Dornier Do 24 and Do 26 long-range reconnaissance flying boat; the new type Messerschmitt Me 208 and the Messerschmitt Me 109F. Two French types are also known to have been ordered by the Germans, namely, the "Caudron Goéland" communication aircraft and the the Bloch 157 single-seater fighter, which is described elsewhere on this page.

Luftwaffe's French Aircraft

THE S.N.C.A. du Sud-Ouest is also engaged on the production of two types ordered by the *Luftwaffe*. One is the Bloch 157 single-seater fighter developed from Bloch 151 and 155. Although full details of the machine are not available, it is known to be an all-metal low-wing monoplane, with a gross weight (unarmed) of 6,835 lb. and a wing area of 207 sq. ft. The fighter is powered with an air-cooled Gnome-Rhone 14 R of approximately 1,400 h.p. and fitted with a two-speed supercharger. The Bloch 157, which is undergoing tests, is said to be capable of a top speed of 420 m.p.h. at 26,250 ft.

The other aircraft in production for the Germans is the Bloch 162 long-range bomber. No details of the aircraft are available at present, but according to reports it has a gross weight of 44,000 lb. and is powered with four Hispano 14 A.A. twin-row radials of 1,100 h.p. at 13,000 ft.



SUBTERRANEAN: A German munition factory built underground and well camouflaged. The structure is in massive reinforced concrete. Natural elevations in the surrounding countryside have been used to make it less conspicuous. On the left are the entrances.

U.S. ARMY
"The cry is for ACTION, for OFFENSE."
--and Curtiss planes again are striking with bombs, with bullets.
Curtiss Wright
FIRST
Since the Birth of Aviation
1933 • First Army Hawk, 420 h.p. Flown by Lt. R. L. Maughan in first coast-to-coast, dawn-to-dusk flight—150 m.p.h.
1929 • Six years of development finds this P-6 Hawk with greater horsepower—625—and many improvements.
1937 • Retractable landing gear (a 1933 development on the Navy Hawks), a speed of over 300 m.p.h., a 1100-H.P engine, were among the notable advances on the P-36 series.
1941 • Since the production of the original P-40's, this famous series has undergone four successive "step-ups" to new high performance levels in speed, ceiling and striking power.
Send for YOUR copy of this fascinating 64-page history of aviation by Assen Jordanoff, author of "Your Wings", with illustrations of current fighting types. Send 10¢ to cover mailing cost: Airplane Division, Curtiss-Wright Corp., Buffalo, New York.
Your WINGS
CURTISS-WRIGHT
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AIRPLANE DIVISION

"THE CARTHOM TRAINER"

A Link Between Theory and the "Link" : A.T.C. Squadrons Can Build This New Ground Trainer at Small Cost

THE LAYOUT : (Left) the pilot's "cockpit." (Back centre) the crab on its table with tapping key for beam signals at far end. (Right) control table with 4-valve oscillator.

IN spite of the valuable work the A.T.C. is doing in providing a thorough grounding in essential subjects for future R.A.F. and Fleet Air Arm personnel, both ground staff and aircrew, and in spite of the enthusiastic praise and insistance on its importance to the war effort emanating at frequent intervals from persons in high places, almost every local A.T.C. squadron commander will tell you that life is made decidedly difficult by shortage of funds.

That being so, any device intended to appeal to the A.T.C. must of necessity be inexpensive, and if it can be "home made" from odd scraps and pieces which can be begged, borrowed, scrounged or bought for a song, then so much the better. Withal, however, it must do the job for which it is intended efficiently.

No doubt Mr. W. G. Carter and F/O. G. E. Thomas, of No. 1318 Squadron, Staveley, Derbyshire, had well in mind the need for efficiency at very low cost when they designed and constructed their "Carthom" ground trainer. At all events, they achieved startling economy by building the prototype for a total outlay of "a little under £2," while the result of their collaboration is reported to be proving so popular with the A.T.C. that its efficiency may now be taken for granted.

What It Can Do

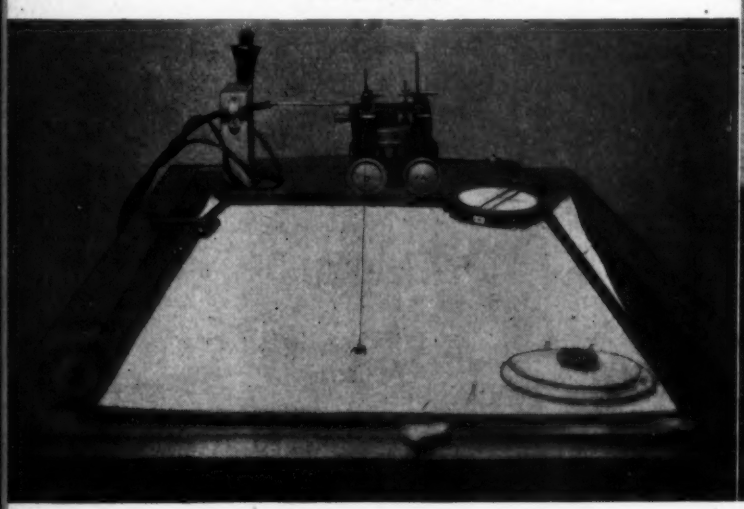
Before actually describing the Carthom trainer, it will be as well to make it clear that its joint designers do not for one moment claim that it can teach a cadet to fly, or even that it can compete directly with the famous Link trainer in providing the sensations of turning and banking and thus accustom the pupil pilot, in some measure, to the "feel" of an aircraft in flight. What it can and does do, however, is to teach him how to operate the standard R.A.F. blind-flying panel, how the various instruments respond to any given movement or combination of movements of the controls, and provide him with useful practice in the co-ordination of eyes, hands and feet. It also accustoms the pupil to being confronted by an array of dials and can be used for at least one purpose outside the scope of the Link—that of providing a crew of four with exercise in cockpit teamwork and with simultaneous instruction in the work they will be called upon to do when they ultimately become R.A.F. aircrew.

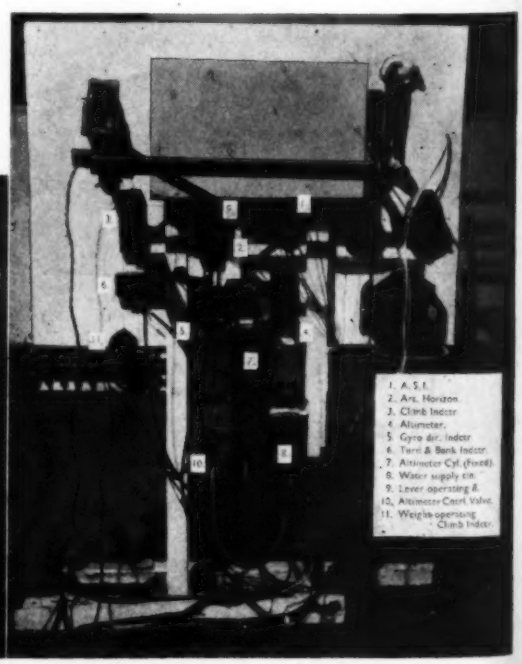
Resemblance to the Link

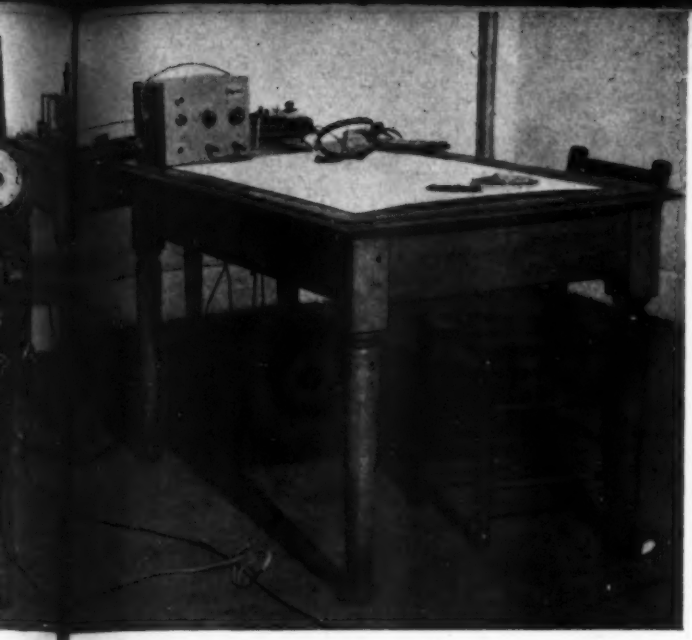
Inasmuch as the Carthom consists of a dummy "cockpit" from which the pupil pilot controls the movements of a remotely situated mechanical crab, tracing his course in graph fashion, it can be said to resemble the Link in its strategic approach to the instructional problem. But since the A.T.C.'s resources are not those enjoyed by the R.A.F. (far from it!) the actual tactics employed to execute this strategic plan are very different, as will be seen.

In the first place, the Carthom pilot dispenses with the lifelike cockpit in which the Link pupil is installed, contenting himself with an ordinary chair on which he sits in front of a dummy instrument panel, control column and rudder bar. This panel contains nearly all the dials found on a modern aircraft, all the appropriate ones such as the A.S.I., altimeter, turn and bank indicator, artificial horizon, climb and descent indicator, R.P.M., boost and oil

(Below) The "crab" table, showing pen linked by thread to motor spindle and control cable from rudder : above the anchor-post is a red signal lamp for bombing practice and, on the right, a C/D calculator. (Right) Behind the instrument panel : it looks a bit complicated, but the numbered parts with key inset should simplify matters.







pressure gauges, responding to the flying controls and engine throttles in realistic fashion. For crew training, a table is set close to the pilot for the navigator and wireless operator.

At a second and larger table, set far enough away from the pilot and his crew for them not to be able to see what is happening to the crab, sits the officer representing the ground station control. On this table is a map covered by a sheet of glass, and it is on this glass that the pen of the moving crab marks the course steered by the "aircraft." The navigator has a duplicate map and a computor and, by means of the Bowden cable connecting the "aircraft" to the crab, the course worked out by the navigator and steered by the pilot is reproduced on the instructor's map. Incidentally, the idea of covering the instructor's map with a sheet of glass is merely to avoid marking the map itself; the pen is of the type normally used in recording instruments, and the glass takes the ink quite satisfactorily and can, of course, be wiped clean afterwards.

The means by which the various dials are made to respond to the controls is as simple as it is ingenious. Unfortunately, there is no space here to describe each one in detail, but briefly, it is contrived by a system of Bowden cables, levers and pulleys.

Fishing line has been found best for the mechanism operating the altimeter, which is particularly clever, for when the "stick" is pulled back, a water container behind the panel is raised, causing water to flow into another vessel; this raises a float and records increasing altitude on the dial, the machine's ceiling being dictated by the limit of the float's travel. If the stick is centralised at any time during the "climb," a gland cock is closed and the altimeter "stays put" at whatever altitude it is then recording. When the stick is pushed forward for descent, the float is lowered and the pointer responds accordingly.

Control Connections

It will also be seen that the *rate* of climb or descent is recorded because the amount by which the control column is moved forwards or backwards from the central position governs the extent to which the gland cock is opened.

Without going into further details, it will readily be understood which controls must be connected to the various dials; the A.S.I., for example, must be linked to both the throttle and the fore-and-aft movement of the stick, the artificial horizon to both stick and rudder, the R.P.M., boost and oil-pressure gauges to the throttle, and so forth. Since the "aircraft" does not move, a real compass is not required, and in any case the modern pilot uses the gyro directional indicator once the machine is set on its course, referring to the compass only occasionally as a check. A dummy "home-made" compass can be constructed from an A.T.C. compass card pasted on a metal or plywood disc, and the grid wires, finger and lubber line appropriately painted so that the pilot can "set" his compass to the supposed course.

Levers for operating the undercarriage, flaps, etc., may be provided to give realism to the cockpit drill, together with engine switches and similar fittings not directly concerned with actual flying.

How the Crab Works

Now for a brief description of the crab, which is basically a clockwork gramophone motor mounted on four model "meccano" wheels. This is moved on its rail track across the end of the map table by means of a heavy-duty wire cable (e.g., a speedometer drive) connected to the rudder bar. To the main spindle of the motor is attached a length of thread reaching to the far end of the map, where the pen on its support is attached. When the motor is started the pen is drawn across the map, and the course steered by the pilot is thereby traced in ink. As the speed of a gramophone motor is variable, it can be graduated according to the scale of the map to represent any required "flying speed"; on the prototype Carthom a "2 miles=1in." map gives flying speeds from 150 m.p.h. to 450 m.p.h.

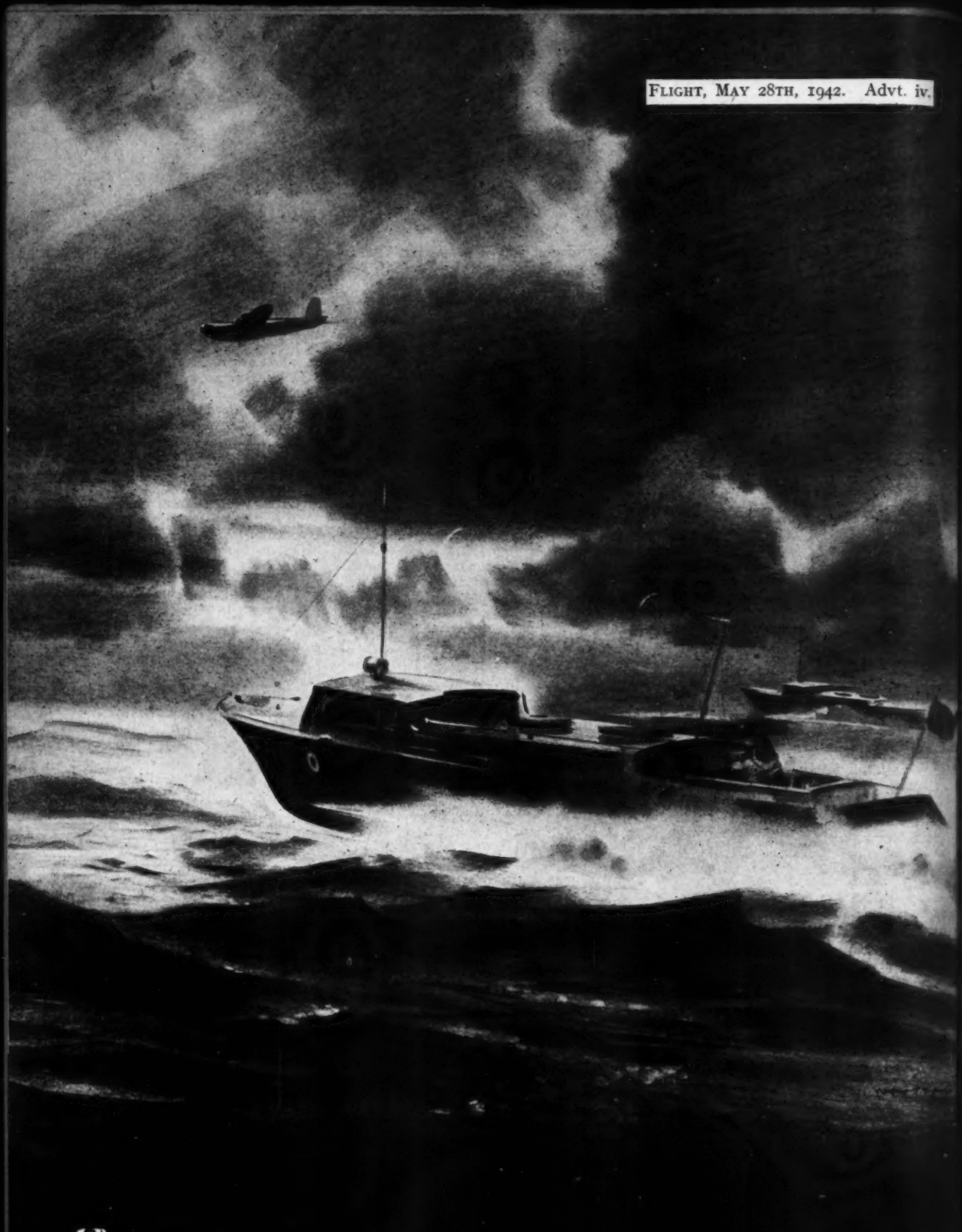
The crab, of course, is controlled by the instructor who, after a little practice, will soon be able to judge the required speeds at which to run the motor to within a few seconds of the correct "flying time."

The instrument dials, it should be explained, are painted on the black panel in white paint, and a batten is mounted on brackets behind the panel to carry the simplest form of "bearing" at the other ends of the spindles which actuate the pointers, and which carry the levers for their linkage with the appropriate controls.

All kinds of flying exercises can be arranged with the Carthom trainer, including beam approach, and if the pilot makes a miscalculation when making a blind landing on the beam, and the pen crosses the home airfield before the "aircraft" is properly down, a "crash bell" rings to indicate he has collided with the fence. Spins and their recovery can also be taught and practised.

The designers will be pleased to co-operate with any A.T.C. squadron in the construction of the Carthom trainer, and enquiries should be sent to them, c/o the *A.T.C. Gazette*, 1a, Pall Mall East, London, S.W.1.

THE "OFFICE": The simple form of dial used is clearly shown, not to mention the scrap car wheel on its tubular column. On the left of the panel can be seen the dummy compass, bomb-door and engine switches, etc., for cockpit drill.



Walton high speed craft for air co-operation

Fast tenders for service, repair and rescue work
Medium Speed general utility launches

THE WALTON YACHT WORKS LTD.

Two Russian PE2 low-wing, twin-engined medium bombers. The PE2 carries a crew of three or four and the bomb aimer's position is on the floor of the nose. A bomb load of 1,700 lb. is stowed internally. Top speed is believed to be slightly over 300 m.p.h.

AIR FIGHTING IN RUSSIA

The Russian Recovery : Soviet Air Force Takes the Initiative : The Ice-bound Luftwaffe : The Effect of Winter

By V. L. GRUBERG

THE thawing weather must have come as a welcome relief to the snowbound, frozen and immobilised Nazi forces. For the past winter has been a period of privations and disaster, reverses and losses, not experienced before by the *Luftwaffe*, and so much more acute because unforeseen in the scheduled time-table of the German war machine.

Since one chapter of the strife is closed, it seems appropriate at this juncture to sketch a picture of the developments and conditions which have marked the period of operations prior to the opening up of the new phase of the campaign.

After the initial blows delivered by the *Luftwaffe* in the opening stages of their aggression against Russia, the Germans announced that the Soviet Air Force ceased to exist. But far from being dead, Russia's Air Force merely staggered under the heavy blows received, and not only picked itself up, but was soon capable of inflicting heavy punishment upon the enemy.

The area covered by the final battles of the winter campaign.

This quick recovery could not have been achieved but for the deep, substantial air resources on which the Red Air Force could continually draw. Two factors have considerably contributed towards this phenomenal recovery, namely, the rapid removal of the industrial plants into the strategically safe area, and the quick and efficient reorganisation of the migrated industry. That this gigantic task was so smoothly completed is in itself a brilliant feat of planning. For the difficulties involved must have been tremendous. In no mean manner have the Soviet Air Forces been assisted by the supplies reaching them from their Allies, and the exchange of such technical knowledge and experience as must have been arranged between them.

Operations and Weather

In reviewing the past stages of the air fighting in Russia, one must not overlook the all-important fact that the Germans had the initiative. The element of surprise, the liberty of selecting worthwhile objectives, are those powerful allies of an air force which is in the offensive. The *Luftwaffe* certainly made good use of them, and up to the end of August, 1941, had rendered invaluable service to the advancing German Forces. During this period the Germans constantly employed the air arm in attacks on Soviet communication lines and supply centres. The idea behind these operations was to prevent the mobilisation of the Russian forces and thus reduce their mobility. In the vast spaces with but a modest net of communications, the attacks on the permanent way were certainly of great help to the advance of the German forces. As in previous campaigns of the *Wehrmacht*, the ground forces were given full air support, and, indeed, all operations have been closely linked up with the intensive employment of the air arm in all

AIR FIGHTING IN RUSSIA

the important ground battles.

The beginning of autumn marked the opening of the second phase in air fighting. The *Luftwaffe's* task was to force Moscow and Leningrad to submission, or at least to render their defences useless and pave the way for the capitulation of these cities. During this phase of fighting the Germans used their air units in mass employment, attacking in waves of about 100 planes. But just as their ground forces were pinned down within the sight of Moscow and Leningrad, so has the *Luftwaffe* experienced at the gates of the capital a most serious reverse.

Moscow and Leningrad just were *not* like some other cities of the Continent; they could not only "take it," but what is in fact more important, "give it," and give it in full measure. The resolute operations of the Soviet air units charged with the protection of these two cities, and their A.A. defences, have enforced their superiority on the *Luftwaffe*. With the approaching winter the German Air Force had to face, therefore, a hitherto unexperienced situation—that of being strategically on the offensive and within easy reach of an important objective, but being compelled gradually to fold their wings.

A vee formation of L.16 Rata single-seat fighters. Top speed varies with the type of engine fitted. Early models of 650 h.p. could only manage 280 m.p.h. as a maximum, but with a 1,100 h.p. engine over 300 m.p.h. is obtained.

A Messerschmitt Me 110 shot down in the snow. Deep snow and cold must have made it impossible to rescue many of the injured air crews.

The bad weather setting in, turned their advanced landing grounds into waterlogged fields and, except for airfields captured from the Russians, the mobility of the *Luftwaffe* was thus substantially reduced. It is to the credit of the Command of the Soviet Air Force that the advantage so gained was turned into something even more serious; the Soviet Air Force contested bitterly for superiority of the local air space and has succeeded in wresting the initiative from the *Luftwaffe*.

This transition from the defensive into an offensive was perhaps the turning point of the campaign. Clearly, the Russians could not have achieved what they have done without considerable losses. But the end well deserved the price paid. The *Luftwaffe*, deprived of the offensive advantage, had to fall back, and a new phase of the air fighting began.

At the beginning of November came a considerable reduction in the activity of the *Luftwaffe*. While in November 2,500 sorties were made on the Northern and Central Sector, only 1,550 were made in December, the figure including patrol flights. The same slackening of operations was observed in the Central and Southern sectors of the front, where 1,047 sorties were made by the *Luftwaffe* compared with 2,038 in November. In the attacks on Moscow only 20 to 30 machines were raiding in the first half of December, and as few as 10 to 15 in the second.

"Luftwaffe" Checked

What was the reason for this sharp reduction of offensive activity? Maj.-Gen. Grendal, of the Soviet Air Force, writing in the *Red Star*, attributes it not to a shortage of aircraft, but to operational difficulties resulting from bad airfields, difficulties in starting and maintenance caused by the severe cold and the unprepared ground organisation.

This has been confirmed not only by pictures released by the German Air Ministry showing the difficulties of operations and maintenance under Russian winter conditions, but in German reports, in the despatches of their correspondents from the front, and, finally, in the utterings of their official spokesmen. Indeed, these reports purport to show that the ground organisation of the *Luftwaffe*

has borne the brunt of the difficulties, in having had a very hard task to fulfil under hazardous conditions of life.

During the battles of the winter, the *Luftwaffe* suffered not only because it was badly prepared for a winter campaign, but also because of the pressure brought to bear on it by the Russians. The havoc wrought by the Russians on the enemy's airfields, particularly on the central front, added to these difficulties. This particularly affected such units which were called to succour the hard-pressed German ground forces. Indeed, during this period the *Luftwaffe's* main task was to interfere in the ground battle to relieve the *Wehrmacht* and to use transport planes for the despatch of reserves and supplies to advanced zones.

Transport aircraft attached to the 11th Air Corps, which were held in readiness for parachute operations, were released in mid-winter for other purposes. The air-borne units attached to the above Corps were used as infantry to close up the gaps, and an "express service" was established for carrying troops from deep in the rear to the front. In January fresh troops from Denmark and Yugoslavia were transported by plane to the front. On many occasions when reserves were badly needed, they were transported from one front sector to another by air, and supplies despatched to encircled or exposed units.

Losses in Transport Aircraft

Thus, in the Briansk area, towed gliders were used to deliver supplies to the encircled German garrison in Sukhinichi. Since the poor armament and manœuvrability of these transport planes have made them a particularly easy prey for Soviet air units, their main operations were either at dusk, sometimes at night or in bad weather. Nevertheless, the toll taken by the Red Air Force of the 11th Air Corps was very heavy; for these operations necessitated the despatch of heavy transport aircraft to advanced positions, involving landings in the immediate vicinity of fighting, or beyond it, constantly in danger of the swift advance of the Soviet units. Great numbers of the Ju 52 (which, despite the presence of some Ju 90 and Fw 200 types, were the main equipment) were destroyed by the Soviet Air Force on these advanced airfields.

These systematic raids on German airfields have seriously contributed towards a further crippling of the enemy's air activities. It is significant that over 36 per cent. of German aircraft destroyed by the Soviet Air Force in February was smashed on the ground. The air fleets of Generals Kellers, Leers and Stumpfs have suffered important losses in Ju 87, Me 109 and 110, Ju 83, He 126. The Soviet Air Force seized on the offensive, and relentlessly kept on the pressure.

Starting troubles in the cold. A Henschel 126 army co-operation machine with quilted engine cover has hot air pumped in to thin the oil.

While the Russian armies were driving wedges and gaps into the main body of the enemy, the Soviet Air Force played a no less important role in the advance. Not only did air units, by continuous reconnaissance, facilitate the planning of operations and the most advantageous tactical employment of the ground forces. All Soviet operations showed a matchless collaboration of the Air Arm with the land forces, throwing their weight on vital points of thrust and relentlessly hammering the enemy's ground positions. Of particular value to the Russian offensive was the employment of air units in attacks on enemy supply columns, on retreating forces, in striking in his rear, and on new positions taken up in the retreat.

The *Luftwaffe*, having received reinforcements from the hinterland, struck out again and again. In February air fighting flared up again, the Germans trying to wear down Soviet air resources and to relieve their pressure on the ground forces. But the margin of advantage already gained by Russian flyers was apparently too much for the *Luftwaffe* to overtake. The Soviet Air Forces continued to exercise their air superiority over the front, as demonstrated by their frustration of vigorous attempts by the encircled German garrison in the Yukhnov area to withdraw to the north-west.

With the improved weather the Germans had to intensify further their activities. While in February they operated in small units, they have now gone back to the employment of larger numbers of aircraft, in units of about 50. In the ensuing operations the *Luftwaffe* spared no efforts to recapture the superiority gained by the Russians during the winter

(*Continued on page* 536.)

Junkers Ju 87 dive-bombers crossing the Black Sea coast.

IN PARLIAMENT

Progress of the R.A.F. Regiment : Night Bombers' Instructions : B.B.C. Statement : Civil Aviation Salaries : Skilled R.A.F. Engine Fitters Sent to Unskilled Jobs

Royal Air Force Regiment

Wing-Commander Hulbert asked the Secretary of State for Air whether he can make any statement about the progress of the formation of the Royal Air Force Regiment; and whether he is satisfied with the scope of its activities?

Sir A. Sinclair: Good progress has been, and continues to be, made with the organisation, manning, equipment and training of the Royal Air Force Regiment. The answer to the last part of the question is in the affirmative.

German Targets

Mr. McGovern asked the Secretary of State for Air whether the instructions to the Royal Air Force who raided Lubeck and Rostock included instructions to impede and disorganise the German effort by the destruction of workmen's dwellings?

Sir A. Sinclair: The objects of our bombing offensive in Germany are to destroy the capacity of Germany to make war and to relieve the pressure of the German Air Force and Armies on our Russian allies. No instruction has been given to destroy dwelling houses, rather than armament factories, but it is impossible to distinguish in night bombing between the factories and the dwellings which surround them.

B.B.C. Air Raid News

Mr. McGovern asked the Minister of Information whether it was with his authority that the British Broadcasting Corporation announced on Sunday evening, April 26th, that the Royal Air Force who raided Lubeck and Rostock had destroyed a large number of workmen's houses, and that it was necessary to destroy workers' dwellings in order to impede or disorganise the German war effort?

Mr. Bracken: The B.B.C. does not issue news under my authority, but compiles its bulletins from the same sources of information as are open to the Press. These, of course, include official bulletins and summaries.

Civil Aviation Personnel

Mr. Garro Jones asked the Secretary of State for Air how many persons are employed by the Air Ministry on civil aviation; what is the total amount paid in salaries; how many of these salaries exceed £1,000 a year; and whether these appointments are in addition to those held in civil aviation by employees of the British Overseas Airways Corporation?

Sir A. Sinclair: The number of persons employed by the Air Ministry on civil aviation duties on April 1st, 1942, was 282, of whom 154 were employed at out-stations. Of these latter, 83 were employed at requisitioned aerodromes which are not used exclusively for civil aviation purposes. The annual cost of salaries and wages is £80,857. Five of the staff receive more than £1,000 a year. The answer to the last part of the question is in the affirmative.

B.O.A. Remuneration

Mr. Garro Jones asked the Secretary of State for Air whether British Overseas Airways Corporation, Ltd., have established an airways fund under Section 17 of the 1939 Act?

Sir A. Sinclair: Yes, Sir.

Mr. Garro Jones asked the Secretary of State for Air who are the present chairman, deputy chairman, chief executive member and the members of the British Overseas Airways Corporation; and what remuneration each received in the year 1941?

Sir A. Sinclair: The chairman and the deputy chairman of the British Overseas Airways Corporation are the Hon. Clive Pearson and Mr. I. C. I. Geddes respectively. The chief executive member is the Hon. W. L. Runciman, and the other members are Mr. Harold G. Brown and Mr. Gerard d'Erlanger. No remuneration is paid to the chairman or the deputy chairman or to any member of the Corporation as such. In accordance with the provisions of Section 1 (6) of the British Overseas Airways Act, 1939, the remuneration paid by the Corporation to the chief executive member is a matter for the Corporation to determine.

More Square Pegs ?

Mr. A. Edwards asked the Minister of Aircraft Production whether he is aware that more than 100 fitters, released by the Royal Air Force to help in aircraft production, are employed on unskilled work at a factory not connected with aircraft engines on which these men have been trained; and what steps he proposes to take to have these men more profitably employed?

The Minister of Aircraft Production (Colonel Llewellin): Forty-eight men released from the Royal Air Force are employed at the factory in question. They have not all been trained on aircraft engine work. The Ministry of Labour allocated them to the vacancies considered most suitable in the light of their training in the Royal Air Force, their pre-enlistment industrial experience and the relative urgency of the various demands. They are all employed on work of vital importance.

Mr. Edwards: How can the Minister reconcile that statement with the fact that these men had 12 months' training on Rolls-Royce engines and were released because they expected to help in the war effort by producing more engines?

Colonel Llewelin: I am told they were not all trained on engine work. We have plenty of people in engine factories at the moment. Where labour is most wanted is on work such as that on which these men were employed, where most vital work is being done.

Mr. Edwards: How is it, then, that since I raised this question some men have been released for work on Rolls-Royce engines? The statement the Minister made was positively untrue. It is not good enough that he should make such statements to the House.

Factory Security Officers

Mr. Neil Maclean asked the Minister of Aircraft Production in how many aircraft factories there are security officers; whether he can state the nature of their duties; whether these officers are responsible to, and make reports direct to, the Minister or to the firm; and whether the power of dismissal of the security officers rests with the Minister or the firm?

Colonel Llewellin: All important aircraft factories are "protected places" under the Defence Regulations. In each protected place a person, normally the general manager, is made responsible for security measures within the factory. It is usual for the firm concerned to appoint a special security officer to assist in the discharge of this responsibility; he reports to the firm, by whom he is appointed and by whom he may be dismissed.

Mr. Maclean: Has the firm the sole right of dismissal or the Minister?

Colonel Llewellin: The firm.

"AIR FIGHTING IN RUSSIA" (*Continued from previous page*)

months. But this was hard to regain. Soviet Air Forces continued to harass the enemy's ground forces in day and night time, methodically wearing them down.

In these harassing operations low-flying night attacks were particularly effective; Russian bombers would usually fly in pairs, withdraw quickly after attack, and, after an interval long enough to allow the German troops to settle down, another pair of bombers would come up and play the game. The *Luftwaffe*, on the other hand, found it necessary to employ fighter formations for the protection of their tactical bombing and transport operations.

The privations suffered during the winter months have considerably undermined the actual and potential strength of the *Luftwaffe*. There is no doubt that a large section of the "elite" of the crews perished. The losses of aircraft were extremely heavy, and have most likely influenced the course of operations planned by the *Luftwaffe* for other theatres of war.

Even if only German reports are admitted as evidence, it is apparent that the pressure of Russian air operations and the almost petrifying cold have wrought havoc with the ill-clad and ill-prepared men and machines of the *Luftwaffe*. This reduction in operational capacity becomes even more striking when one remembers the other fronts the *Luftwaffe* has to contest, and the effect of the R.A.F. raids on Germany's air-power resources.

Topics of the Day

ODDITIES

"Indicator" Goes "Yogi" and Jumps from Applied Metaphysics to Pre-war Airline Operation

THIS war is the oddest thing. Not the war itself, but the way in which so many things are reversed. For instance, you may have an airfield studded with defence posts, engulfed in barbed wire, and surrounded, perhaps, by tough individuals with tommy guns, rifles or halberds. Nobody can get in (at least through the main entrance) without encountering fearsome Service Police and without the need for producing identity cards and what not. Yet, if you take an aircraft of any breed, Service or civil, camouflaged in the correct manner, and fly to an airfield looking just what you are, an enthusiastic and rather scruffy civilian, you can step out of that machine and wander all over the place, peeping into secret and pseudo-secret aircraft, without interruption.

Of course, if you arrive in a *Luftwaffe* suit, with a Heinkel 111 and speak no English, a certain degree of surprise will be felt by all concerned, but I am supposing that the clothes and manner are normal. Everyone on the flying field will think that you are a super Air Ministry person, or a test pilot of great renown.

Fill Up and Fly Away

Having seen all you wish to see, if will usually be possible to take your aircraft to the Bowser and have it filled to the brim (Service Bowser experts rarely fail to fill up every visible orifice from header tanks to de-icer containers) with magnificent 100 octane fuel. Crowds of people will then help you to start up and you can fly merrily away to another airfield.

Unfortunately, sooner or later, you will have to go out to get a meal or to buy a clean collar, and you will be very much in the soup unless your papers are in order.

Apropos the filling-up of aircraft, when I used to ferry machines about the place I often thought how easy it would be to make a grand tour of the British Isles in some nondescript aircraft, filling up without doubt or question at any and every airfield. Of course, your unit or factory, or whatever, would wonder where you'd got to, and the machine's papers would look just a little odd on your return home.

None of which must be construed as a criticism of any existing system. It would obviously be impossible to scatter Service Police all over the inside of every airfield; it would be very impolite and difficult if every person on an airfield were questioned and examined at regular intervals and the ordinary person, whether Service or civilian, is usually much too busy to find time to bother about odd persons unless their actions are "suspicious" (whatever that may mean); and it would be totally impossible if every arrival by air had to be questioned and have some form signed by the commanding officer before his machine could be refuelled. Speed is the essence of the matter of getting on with the war, and, I, for one, am all in favour of getting on with the job with as little red tape as possible, even if, once in a thousand times, somebody or other cares to take advantage of a mildly strange situation. It's just one of those things, but I still think that the whole affair is queer, at least when compared with peacetime conditions.

But then it is equally queer for so many of us to find ourselves in sole charge of some magnificent contraption with rows of engines when, three years ago or less, any multi-engined affair was approached and flown with the greatest trepidation, and our normal means of aerial conveyance was a Puss-Moth or some such. I occasionally suffer moments of most intense surprise and shock: so much so that I sometimes wonder whether the whole thing isn't something of a fluke, and whether the bubble of comparative flying efficiency will not one day crash and burst.

The majority of pilots, and certainly those with a twisted and introspective turn of mind, occasionally have fits of looking above and below the wings while flying, and wondering what on earth is keeping the thing up. A sort of battle between Messrs. Newton and Einstein, one presumes. Fortunately, or unfortunately, old Isaac usually wins in the end. Another spot for warped minds is that of sitting down near an airfield and "doing a Yogi" until all knowledge of modern inventions and happenings has been partially erased from the thoughts; one then looks sharply up and wonders alarmingly what that loose, noisy thing is, why it is up there at all, how it stays there, and who made it. The game is played best at a point near the leeward fence, where the strange objects are large and near, and not moving too quickly. To the artificially untutored mind aircraft are very odd things indeed.

Such exercises may appear to be childish, but if, on occasion, everything appears to be becoming a little too much, they certainly allow one's troubles to be put into their correct perspective. Even the very worst is not so bad. As the Irishman might have said, "What are you worrying about? Millions of people have died and survived it." If you like such things, you can even Yogi yourself into becoming a visitor from another planet altogether. That's really interesting, but more than a little detached from flying, as such—useful as a sort of holiday during the delays which are inseparably connected with flying!

That, incidentally, is yet another curiosity which has not changed with the war. If only it were possible to get rid of delays, flying might become quite a swift means of transport. As it is, one sits interminably, waiting for weather or for the cowlings to be put in place, and then makes a furious and noisy dash from place to place. The only difference, as far as I am concerned, between the days of peace and of war is that the peacetime "dashing" was at a humble 110 m.p.h., while the wartime "dashing" really is dashing. Unless you are an operational pilot with radio and all that, the delays are usually more prolonged, because, whereas at 110 m.p.h. it was only necessary to see half a mile, it is advisable to arrange a somewhat wider field of vision when miles are being covered at four a minute or more.

Private Radio

During the year or two before the war, these delays really were being finally removed from "official" civil flying, and the airlines were running very well indeed. They had been through a period, in Europe at least, where the desire to keep to schedule had overruled good sense, and the accident rate had been fairly high. This was partly caused by a too-sudden jump from common sense and look-see to applied science, but the main reason of the series of accidents was undoubtedly the result of inter-airline competition and of a desire to show the world of ordinary people that airlines were both faster than other means of travel and equally reliable.

By the time this war had started, the companies had grown out of the competitive spirit, and the question of whether or not a service should be run was decided in equal measure by the pilots and the operational and weather staff. As far as British civil airline companies were concerned, the war could not possibly have started at a less opportune moment.

But, of course, the ordinary amateur pilot carried out his hit-and-run flights, and he spent 90 per cent. of his time on the ground during "flying" periods. No really popular radio equipment—with R/T ground stations—had been planned or evolved, and the amateur travelled by the old "no see, no fly" methods. Very sensible, in the circumstances; that is definitely the only way to fly unless you are entirely competent and are carrying an equally competent crew.

"INDICATOR."

FLIGHTS OF FANCY

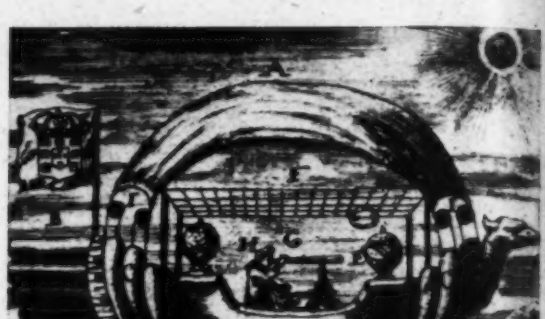
Our Ancestors Cried for the Moon : Stratospheric Excursions by Writers of the Past

By MICHAEL LORANT

MANKIND can hardly remember a period when the problem of stratosphere flights has not been in evidence in human thought, however incredible it sounds. To break away from the earth, to explore that mysterious element, the air, to fly like the birds, has been man's dream ever since he has learned to walk upright, but long before physicists discovered that air does not reach all the way up from the earth to the moon, men have longed to fly in order to get in touch with the sun, the moon and the stars. Above all, it is the moon that has always loomed large in the imagination of our ancestors, a big silver temptation hanging in the nocturnal sky, seeming so near that it were almost within reach, if only the little problem of flying could be solved.

Much has been written of the flying experiments of antiquity and during the various periods of history, but all those would-be-airmen, from Icarus of Greek legends, with his waxen wings that melted as he approached the sun, to Leonardo de Vinci who based his experiments on the technique of birds, were concerned with the problem of getting away from the earth and flying through the air.

There is another group, however; those whose ambition and imagination make them the predecessors of Piccard and that of the substratosphere and stratospheric machines of to-day. Those who cried for the moon, i.e., who wanted to fly through the stratosphere, or imagined what it would be like, pretended they had done it. . . .



A drawing of the "flying ship," with the description of which an unknown humorist swindled newspaper readers and scientists all over Europe. From a Vienna newspaper of 1709.

Ten Duck Power

And the burning interest with which the public, in all ages of history, swallowed these stories, is a proof that mankind has always regarded the stratosphere as its birthright and the moon as a sort of colony, made to be conquered by terrestrials.

As far back as in ancient Babylon, certain inscriptions tell us, there was a man who rode upon an eagle in order to reach the stars. What happened to this stratosphere flier four thousand years ago, is unknown to posterity. But the idea of using birds as the means of locomotion to reach the stratosphere prevailed for thousands of years.

The first trace in literature of "crying for the moon" is the famous novel of Bishop Francis Godwin, entitled "A Man in the Moon." It was published in the year 1638. It is the romantic story of a Portuguese sailor named Gonzales who was lost in a shipwreck. Stranded on a desert island, Gonzales built a light frame out of timber that drifted to the shore, to which he harnessed ten American ducks (their strength seemed to be regarded as prodigious by the English Bishop) which safely flew with him across the ocean to dry land, not without paying a "flying" visit to the moon first. The book was one of the best sellers of its time—though what a publisher of our own days would think of its sales figures is another question—and was translated into several languages.

Victorian jet propulsion. A caricature of the steam sky-rocket flying machine patented in London in 1843. From an English newspaper.

Cyrano de Bergerac

It inspired one of the wittiest, strangest, most memorable characters of XVII century France to write another book on a similar subject.

Savinien de Cyrano de Bergerac, soldier, cavalier, duellist, poet, physicist and owner of the longest nose in the Kingdom of France, has been immortalised by Edmond Rostand in a play that was acted thousands of

FLIGHTS OF FANCY

times in every civilised language. In an account of his life and his travels, Cyrano de Bergerac describes his flight into the stratosphere, telling how at Toulouse he built a small wooden chamber topped by a large glass sphere into which 20 strong lenses collected the rays of the sun.

Through the sun's rays the atmosphere inside the glass sphere was rarefied and the light air which thus developed raised the apparatus, with Cyrano inside, into the air. Thus the poetic imagination of this curiously romantic character, this Cyrano who was the greatest brawler, swashbuckler, swordsman and one of the most gifted writers and physicists of his day, anticipated the method by which, many years later, the brothers Montgolfier raised their first balloon into the air by filling it with a substance lighter than the surrounding atmosphere.

Dewdrop Lift

This, however, was not the only solution for getting to the moon suggested by the ingenious Cyrano. He had no less than seven methods of stratosphere flying, among which was the device of hanging globes filled with dewdrops on his belt—the sun's rays, drinking up the dew, would raise him into the air. There was also the plan of letting himself be carried away by the tide when there was a full moon. The theory that the ocean tide is influenced by the gravitational power of the moon was already known in Cyrano's time and it was a joke on this theory that Cyrano suggested travelling to the moon by this means.

20-goose Take-off

Of course, all these were merely humorous fancies of Cyrano's imagination, but they made him one of the most fashionable authors of his time and showed the trend of the public's interest.

Another story about a moon voyage was printed at Nurnburg in the year 1684. One of the illustrations to this novel shows the intrepid stratospheric traveller being carried toward the moon by a score of geese harnessed to a wooden frame; another displays a "moonscape" and, far below, the tiny terrestrial sphere.

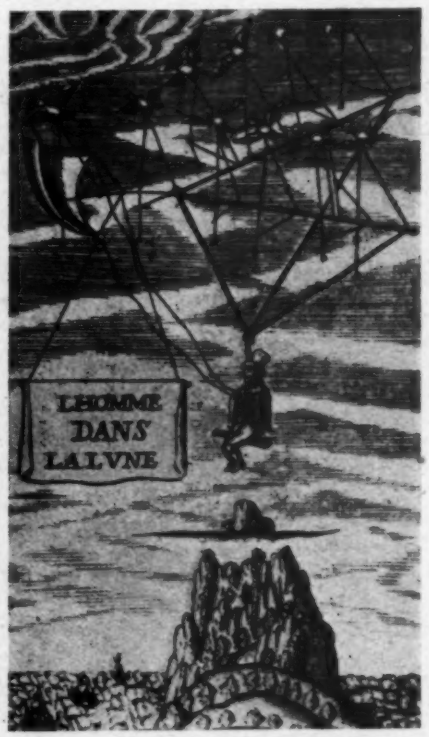
All these stories were frankly imaginative, freaks of fancy, and were regarded as such. A Viennese humorist, however, whose name has not come down to posterity, must have vastly enjoyed the huge joke that lay in the fact that a similar story which he invented was seriously believed by his contemporaries and scientifically discussed. What is more, even posterity believed him and bewailed the loss of the wonderful vehicle in which the unknown inventor accomplished a stratosphere voyage.

On June 1st, 1709, a journal of Vienna published a report on the "Flying Ship," with a picture and an account of the first flight accomplished in it.

The report does not reveal the secret of the power which raises and propels this "Flying Ship," but calls it "an invention that will be of great use to armies in war." The writer goes on to say that in the course of his first voyage he was attacked by various beasts, but escaped, thanks to his rapid loco-

Cyrano de Bergerac on his way to the moon in the "flying chamber" which he invented according to the principles which later led to the experiments of the Brothers Montgolfier.

The fabulous country of Cacklegallinia, or the Wise Fowls. (Above) The apparatus for stratosphere flying in which the Wise Fowls carried the hero of Samuel Brunt's story up to the moon.



The flying decachord. Ten American ducks carry the first intrepid stratosphere flyer up to the moon—on paper. From Bishop Godwin's romance, "A Man in the Moon," published in 1638.

FLIGHTS OF FANCY

motion. He did not land on the moon but passed close enough to observe landscapes, rivers, forests, mountains and valleys, and also the population, strange creatures who appeared to move without legs or feet, but crawled like snails and carried a sort of shield on their backs like the shell of a tortoise. When there is any danger these moon creatures appear to hide within their shells, a convenient arrangement which makes houses or any other kind of shelter unnecessary for them.

With an air fleet of 40 or 50 "Flying Ships," built after his original model, the stratosphere traveller said, it would be easy to direct an attack against the moon and take possession of it. Obviously, the ingenious inventor counted on getting a big order from some hyper-imperialistically minded government for a score or so of flying ships, and hoped to get away with a fat cash advance on it. No government was credulous enough to enter upon his little game, but the airship voyage to the moon was believed and hotly discussed by a great many people.

"Caklogallinia" was the title of another fantastic moon story by Samuel Brunt, published in England in 1727. It was erroneously attributed to Jonathan Swift, being the account of a voyage written somewhat in the vein of "Gulliver's Travels." The traveller, after sundry adventures, finds himself among a people of intelligent fowls, grown to the size of human beings. The cocks and hens of Caklogallinia are agriculturists and their state is as civilised and organised as that of men, down to the detail that money is scarce.

Fowl Air Transport

The novel, written soon after the greatest financial debacle of all times, the Law swindle, projects the conditions of Europe in that day to the fowl country of Caklogallinia. The clever cocks and hens, however, carry their human friend up to the moon, where gold is to be found in plenty. The wise fowls are strong enough to bring plenty of it back to earth and with its help straighten out the finances of their country. This is putting stratospheric flight to a practical use, indeed.

Among the British patents granted in the year 1841 there is one concerning an "air machine" shot up from the earth like a sky-rocket, an invention of a man called Charles Golighty. The description of this patent has never been published. Something must have transpired about it, though, for many caricatures of a sky-rocket flight have been printed in the newspapers. Possibly it was this invention that inspired Jules Verne, the prolific French novelist, who, in his stories that are still beloved by young people in all countries, so wonderfully blended science with imagination. In this "Voyage to the Moon" the journey is accomplished with the help of a huge sky-rocket very like Golighty's.

H. G. Wells' "First Men in the Moon" got there by discovering a substance which resists the gravitational power of the earth and by this means makes it possible to get away from this globe on which we are prisoners, although the bounds of our prison have, in the last 30 years, been stretched to the boundaries of terrestrial atmosphere. Men like Piccard have broken away even from these bonds. What men have been dreaming of during 4,000 years—or longer, for aught we know—may become true within our lifetime.

A voyage to the moon is no longer beyond human possibility. The trouble is that by the time we get there Science has shown us that it is not worth the trouble. . . . There is nothing in the moon worth crying for, so why worry?

KITTYHAWK'S TALONS

The six wing-guns of a Curtiss Kittyhawk being tested at the stop butts of a snow-covered airfield in America. The Kittyhawk is the third in the Curtiss Hawk series. The Mohawk was the first, then came the Tomahawk and now the Kittyhawk itself is superseded by the Warhawk.

Fortieth of the Second Series

FRIEND or FOE?

French Bomber and U.S. Transport

Potez-63 and Electra

POTEZ-63 : Tapered tailplane with dihedral angle; outrigged vertical fins and rudders of well rounded contour.

THESE two twin-engined twin-tailed aircraft offer an interesting comparison from the point of view of specification, performance, and appearance. Although the Potez-63, a fighter-bomber-reconnaissance machine, is some 7ft. 6in. less in wing-span than the Lockheed Electra, and is shorter by about 9ft., its maximum accommodation, when used for reconnaissance, is a crew of three, whereas the Electra is designed to accommodate a crew of two and ten passengers plus a small amount of baggage or freight.

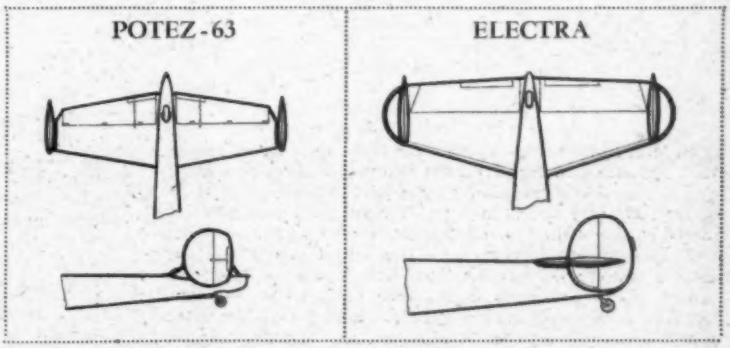
At its maximum weight as a bomber the French machine scales 9,680 lb., as against the Electra's 12,500 lb. laden weight, and is powered by two Hispano-Suiza 14 Hb radial engines, each of 670 h.p., compared with the 550 h.p. of the American machine's Pratt and Whitney "Wasp" units.

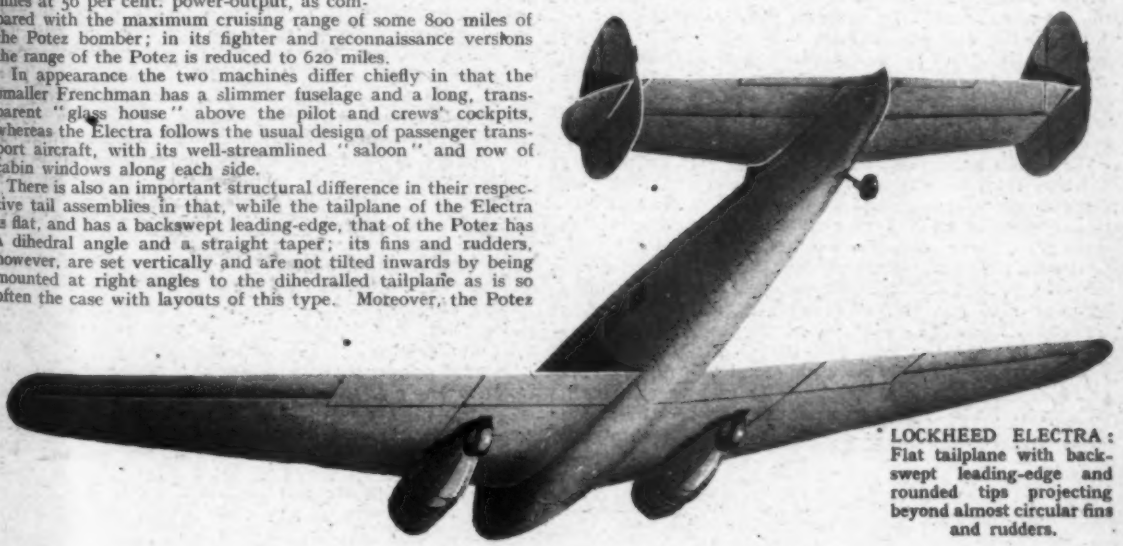
Thus, with its greater power and lighter all-up weight, it is not surprising to find that the bomber version of the Potez has a maximum speed of 280 m.p.h. and an absolute ceiling of 26,240ft., whereas the Electra's top speed is only 228 m.p.h. at a comparable rated altitude, and its absolute ceiling 22,000ft.

On the other hand, the Lockheed Electra scores heavily in the important matter of range when compared with the Potez-63, having a cruising range of no less than 1,020 miles at 50 per cent. power-output, as compared with the maximum cruising range of some 800 miles of the Potez bomber; in its fighter and reconnaissance versions the range of the Potez is reduced to 620 miles.

In appearance the two machines differ chiefly in that the smaller Frenchman has a slimmer fuselage and a long, transparent "glass house" above the pilot and crews' cockpits, whereas the Electra follows the usual design of passenger transport aircraft, with its well-streamlined "saloon" and row of cabin windows along each side.

There is also an important structural difference in their respective tail assemblies in that, while the tailplane of the Electra is flat, and has a backswept leading-edge, that of the Potez has a dihedral angle and a straight taper; its fins and rudders, however, are set vertically and are not tilted inwards by being mounted at right angles to the dihedralled tailplane as is so often the case with layouts of this type. Moreover, the Potez vertical surfaces are outrigged on the tips, whereas those of the Electra are threaded by the tailplane, the rounded tips of which project. Both fins and rudders are well rounded, those of the Electra being almost circular. The slimming of the fuselage at the tail is, of course, much more marked in the case of the Potez-63 than on the Electra, and it will also be noticed that the dihedral of the Potez tailplane raises the fins and rudders in relation to the fuselage.





LOCKHEED ELECTRA : Flat tailplane with backswept leading-edge and rounded tips projecting beyond almost circular fins and rudders.

FUTURE of the AIRCRAFT ENGINEER

Possible Shortage of Skilled Men After the War : Selected Workers Should be Trained for Peacetime Industry

By GORDON H. G. GARBETT, A.R.Ae.S., Grad.I.P.E.

WHAT chances lie in the pale of to-morrow for the younger generation of aircraft engineers who, at this moment, are presented with the opportunity of a lifetime; a chance to learn and train under ideal and prolific conditions all the multitudinous issues connected with the business of aircraft engineering. Undoubtedly, the profession is full of interest, and holds out a certain amount of glamour to those who aim for its higher aspects, for the flying machine, undoubtedly, is possessed of that indefinable aura we call "glamour."

The modern aircraft has made its name, and most certainly its appeal, in this world struggle, and, although the writer does not imply that it has won its appeal through the medium of destruction but rather from its heroic role as defender of the free, who can say we should be free if it had not been for the aircraft? The war has brought it into the limelight, and in that light we cannot fail to see its vast potential possibilities in the fields of industry, commerce and pleasure. The landscape is immeasurable, and though each and all must be concerned with the conduct of the war, we can, nevertheless, mould the material during wartime so that when peace comes that material will be fully processed and ready to take its place in the formation of a new era—the flying age.

Overcrowding ?

Undoubtedly, the question will be asked: "Is not the aeronautical field overcrowded?" And the answer to that is "Yes," but only in the sense that the industry is bloated by staff which has been recruited for the purposes of wartime production, and which, when analysed, can only be regarded as a number of square pegs which have been forced into round holes for the duration. Many people have gate-crashed into aviation, others have been recruited, and all, no doubt, are doing their jobs to the best of their ability. Before one is in a position to make a superficial statement as to the profession being overcrowded, the spotlight has got to be turned on the jobs these people do, and to analyse the specifications which were necessary in order to fit them into these jobs, then to assess their standing on a peacetime basis, and, finally, to estimate what is left for the young aircraft engineer, and how his training should develop, in order that he may be in a position to fill the posts created by post-war development.

Before the war, the industry was beginning to find its legs, as at that period the manufacture of military aircraft was undoubtedly showing signs of progress, even though it was of infinitesimal size in relation to the gigantic programme of to-day. The technicians and scientists had been in the game since the beginning—they were all well trained, and had received their knowledge and experience in the great firms operating at that time, and their progress and development was watched very carefully.

The position of the ground engineer was somewhat different. These men, for some quite unknown reason, have been regarded as the ugly ducklings of the profession, and yet, who could underestimate the qualified ground engineer of to-day, for he has not gate-crashed but rather earned his licences by hard practical experience, and won his job by what he knows of the practical side of the business. One has only to walk round any repair depot or flight shed to appreciate the value of his work, for it is he who leads by the hand that vast array of labour which walks in darkness along the tricky paths of aircraft repair and maintenance.

It is good to know that at last the ground engineer has found his rightful place in aircraft engineering, and it is hoped he will retain his standing when commercial flying is under way.

Just before the production drive began it can be said the technicians and scientists of the aircraft industry were well trained; that they had gained their experience along the leisurely lines of peacetime development and production, and that there was sufficient of them to go round, whereby they could handle the extra work that became necessary by the slight impetus given to the production of military aircraft at that time. Then suddenly, like an avalanche, came the order for more output; shadow factories sprang up like mushrooms overnight, and contracts of enormous size were distributed to one and all concerned.

The result of this was that the industry found itself not only short of labour but of those people who make aircraft on paper—the Boys of the Back Room. The inevitable result was that people who were skilled in the design and production were offered king's ransoms for their services. There arose a great shortage of these people, and they were more sought after than a man with a string of murders in his wake.

"How, then," it may be asked, "is the aircraft industry managing to-day?" This is an important question, for round it hangs the future of the younger generation of aircraft engineers who, at this moment, are engaged upon furthering the end of the war to a victorious conclusion.

To produce the aircraft in the quantity required, it became necessary to break down specialised jobs in the same manner as the manufacturing processes are broken down in order to absorb diluted labour; which means to say you have to-day men and, for that matter, women who call themselves draughtsmen, but who in reality are doing a sub-section of the draughtman's job, which makes it no less important from their aspect, but for the purposes of this analysis it does bring to light the essential fact (which no one "in the know" will query) that these people are only being utilised in such capacity as their short training has enabled them to fulfil, and that, as such, they are not draughtsmen.

Wartime Dilution

The draughtsman's job, like many others, has been broken down to various sub-sections which can be allocated to persons with short training, thus leaving the draughtsman in a position to supervise the work of the drawing office and to concentrate on the problems of their job, which have increased through mass production, constant new designs and modifications. The same applies to planning. These departments of our aircraft factories are filled with people who know nothing of planning beyond its basic principles. Their job is to draw up schedules on information laid before them by the planning engineers.

Of course, it must be admitted that in the aircraft industry, as in other walks of life, you get the exception to the rule; you have the occasional person who studies the art and science of aircraft engineering, and finds himself absorbing it like a sponge. He moves from one sphere to another; his talents are recognised, and he is given a position worthy of his knowledge. So well and good! Conversely, you have the other 99 per cent. doing a part of a very specialised job, and it is at this stage there is the grave danger that the potential aircraft engineer of to-morrow (by this is meant the young engineer whose life is dedicated to aircraft, and who possesses the necessary make-up and talent to become a designer, planner, research or test engineer, or an executive on the production or administrative side of aviation) will be lost sight of in the mass that is only engaged in the industry for the duration. And in being overlooked he will be lost to the industry of to-morrow, which certainly will be in need of first-class

FUTURE OF THE AIRCRAFT ENGINEER

engineers as the new age of commercial aviation develops on an unprecedented scale.

It may be argued against this that the aircraft industry has enough talent to extend over many years of commercial aviation when the war is over; but has it? It must be remembered that much of the talent comes from the motor industry, and that when the war ends, back it will go to automobiles. Anyway, you cannot turn an automobile engineer into an aircraft engineer in the space of a war.

Peacetime Progression

In view of this, these people automatically become ruled out. Furthermore, all those hundreds of people who entered the industry for the duration will withdraw when peacetime development and production takes place, so that all you have left in first-class material are those who were in it before the war, plus those who have progressed so rapidly as to have found themselves a place in the industry. Will this then be sufficient material to cope with an expanding business that will cater for military, transport, freight, and pleasure aircraft? Will there be sufficient engineers of first-class calibre to design, develop, produce and maintain super airlines, air taxis, cargo aircraft and aircraft for the man in the street? If not, what is being done about it?

It is to be hoped that every man is being put to a job for which he is fitted; at the same time it would be a sound plan to earmark these young engineers engaged in industry to-day, and to set up a programme whereby their work shall not be allowed to degenerate into a repetitive process which falls in line with those people mentioned earlier in this article, but rather, that their training and opportunity for varied experience should be developed along the lines of peacetime progression. Their training would be at an intensified pace, and, furthermore, they would practise on processes that formed part of the war production programme. Every young engineer of merit would be given opportunity of training on a wide front, at the same time expending his energy on the war effort.

By adopting a method similar to these basic principles, the aircraft industry would be developing a highly trained nucleus of engineers, who would be well fitted in the years to come to fill with merit those posts which only a trained engineer, possessing the necessary background and imagination, can fill in the ultra-modern field of commercial aviation.

If only six young men possessing latent talent and engineering ability were selected for this training in every aircraft factory, then there would be the assurance that a body of highly trained specialists, in all branches of aeronautical science, would be available to be absorbed in an industry in which this country must make herself "master of the air."

BERLIN-TOKIO

Pre-war German Long-range Trips to the East : Range of the Blohm and Voss "Nordwind" : From the Balkans via Kabul

By KISMET

NOW that the Allies have shown the enormous advantages to be derived from personal contact, in both military and economic spheres, it may well be profitable to examine the chances of Germany's being able to establish and maintain direct communication with Japan.

It may come as a surprise to some readers to learn that all details of such a link were planned as long ago as 1938, when *Deutsche Lufthansa* were entrusted with the work of establishing an air route between the two Axis capitals.

Valuable knowledge of the eastern end of the run was acquired by the "Eurasia" enterprise, largely of German origin. Then, on the occasion of the birthday of the Emperor of Japan, in the year already quoted, a couple of Heinkel machines landed at Tokio after a journey of 55 hours' flying time from Berlin. A very significant point was that they were both flown out to the Far East by Japanese crews. The machines used were He 116 four-engined monoplanes, powered by Hirth HM 508 H type motors of 240 h.p. each.

Wing Spar Tanks

While all this was going on another German concern, Blohm and Voss, was busy perfecting an ultra-long-distance mail plane, the *Nordwind*. This aircraft was fitted with four Junkers Jumo 205 diesel engines, which, thanks to their low fuel consumption of 6 oz. per horse-power per hour, imparted to the machine an enormous range. To save weight there were no fuel tanks, the diesel oil being carried in a tubular steel wing spar holding no less than 1,400 gallons. With a half-ton pay-load the *Nordwind*, cruising at 155 m.p.h., was used for some time on the North Atlantic run, where it proved to be an entire success. Over the same period *Deutsche Lufthansa* were operating the Heinkel 116 between Berlin and Bathurst (West Africa). The pay-load was also half a ton, cruising speed 175 m.p.h., and with a crew of three the take-off weight was 7 tons. Using 8-cylinder Hirth engines, as already mentioned, the range amounted to rather more than 2,500 miles in still air.

Starting a heavily loaded aircraft in perfect safety, regardless of storms, fog or darkness, has not only been accomplished but perfected. By the catapult method the Germans launched machines which could never have left the ground under their own unaided power. It usually requires two seconds in which to accelerate up to a speed of 75-95 m.p.h.; this is quite sufficient to impart full control, and it is attained without the slightest shock.

Dipl. Ing. V. Porger, sometime Chief of the Development Department of D.L.H., always said the weight of the crew, the fuel and oil, and the freight and passengers, should form as large a proportion as possible of the all-up starting weight. He aimed at 50 per cent. as an ideal, and contended that it could be attained; certainly the He 116 comes very near to Porger's figure.

Recent Advantages

With their troops now in the Balkan countries, the Germans could start off from Sofia or Bucharest, instead of Berlin; their first and only halt could be Kabul, in Afghanistan, roughly 2,500 miles. This stage would, perhaps, involve the violation of Turkey (hardly likely to worry the Nazi authorities) and a certain amount of flying over the wilder parts of Russia, which could be done at night. If the Germans decided to respect Turkey, and refrained from flying over her soil, their alternative line would be across the Black Sea. After a brief halt for refuelling, their aircraft could then continue direct to Tokio, via the Takla Makan desert and Inner Mongolia.

This route was actually flown over, developed, and learned by heart; German and Japanese crews both being concerned in the preliminary spade-work. An advantage possessed by the Axis, the value of which is well-nigh incalculable, is their ability to obtain weather reports in detail from both ends of the route, and even intermediately since Kabul is not exactly a prohibited area.

The position is difficult, and if we bring pressure to bear on Afghanistan the Germans will doubtless reply that any such service is purely a civil one, such as we ourselves operate to Lisbon. Yet the danger is there; Staff Officers can pass between the Axis countries in a matter of two or three days; say, the round trip in well under a week.

Correspondence

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

IDENTIFICATION FOR H.G.

Lectures on Recognition Wanted

I BELIEVE many members of the Home Guard will agree with me that the study of aircraft identification is a very much neglected subject. We get quite a lot of lectures on a variety of important and less important topics but we do not get a proper course in the recognition of Allied and enemy planes. Surely, this is an important subject.

Perhaps you would be good enough to bring this matter to the attention of those concerned with our training, so that this drawback should be rectified. SURREY.

HOME GUARD AIR ARM

Privately Owned Aircraft Available

RE H.G.A.A., I am the owner of a Wicko, reg. 1938, last C. of A. taken out August 17th, 1939. I am willing to do anything to support the above; I have done 45 hours' dual and could have taken my "A" licence at any time, but left it too late. I also know of eight other machines, some of which could be put in flying condition in a matter of a few days. For my own part I could spare three or four days a week, and I am only one of hundreds who would be willing to give their time. I should be pleased to hear of any further developments.

W. H. LEADBETTER.

Local Purchasing Groups Suggested

I WAS very interested in the correspondence *re* Home Guard Air Arm in your issue of May 14th. I hold an "A" licence and am a Home Guard, and would be very interested in the development of such a scheme.

Might I put forward the suggestion, if the "Powers that be" accept the idea, and also if there are enough aircraft available, that those sufficiently interested get together to form "groups" from each town to purchase a machine from private owners or firms and so alleviate to a certain extent the rather high initial expense.

With every good wish for the continuance of your excellent journal. D. C. FENN.

Maintenance Problem of Many Types

WITH reference to the suggestion of forming a "Home Guard Air Arm," and the utilisation of stored or privately owned aircraft; would this not produce a variety of types all requiring different types of spares and maintenance.

Would it not be better if the Government or H.G. Commanders drew up a census of pilots and G.E.'s available and, should the number be sufficient and the Government willing, to manufacture a single type of machine (i.e., a type already existing such as the Percival "Gull," in its 3-seater form) in the necessary numbers.

This would make the position of spares, maintenance and identification elementary. The machine could be modified to suit the requirements of the H.G. for such duties as the dropping of supplies, messages, light anti-personnel bombs, the spotting of enemy paratroop concentrations, etc.

Should the parent company of the aircraft chosen for use not be able to produce them quickly enough, all the small aircraft companies could help by producing parts and/or sub-assemblies, this is assuming of course that the machine would be of wooden construction. GEMINI.

AIR POLICY

Bombers Show a Profit

I WOULD like to answer R. J. Brookes' letter published in your issue of May 7th.

He suggests that we stop building bombers and concentrate on building fighter aircraft only. Does Mr. Brookes realise that if we were to stop building bombers it would also mean that we would stop bombing Germany and occupied countries, and if that were the case, the enemy would be at their leisure in building huge stocks of aircraft, etc., unmolested. As it is at present we lose on the average eight to ten aircraft on a large-scale raid. On these raids we destroy factories, etc., building, as in the case of Rostock, large numbers of aircraft, and put the plant out of action for many months. Now, if he were to weigh up the profit and loss, he would find that we were definitely on the profit side. J. LEVY.

ARMY SQUARE PEGS

Another Case of Hope Deferred

I WAS very interested in the letter from "1516246," in *Flight* of May 7th, as my case is very similar.

I also was provisionally accepted as a Flight Mechanic in June, 1941, duly enlisted in October, 1941, and told I would be recalled in four to six weeks. Under the assumption that this was more or less correct, I made certain private and domestic arrangements; thirty-two weeks have now passed and I have in consequence been put to considerable inconvenience.

I find it is not possible to remuster for another trade whilst on deferred service, and am interested to learn from your correspondent's letter that he has been given the option of joining another Service. I would be prepared to consider that course.

My wife is also liable for National Service and wishes to join the W.A.A.F. Naturally, I object to her being called up whilst I am still at home. "1516515."

POWER UNITS OF THE FUTURE

Better, Not Bigger, Engines Wanted

I HAVE read with mixed feelings your article entitled "Power Units of the Future." The terrific American preponderance is undoubtedly due to the American attitude of "Tell the World." Our inherent trait to hush everything up has led to the present belief of the man in the street that every American aircraft is better than its British opposite—or thoughts to that effect.

From the older firms these tales of 2,000-3,000 h.p. engines can be accepted; such things are on the way, but can a firm which has never built an aircraft engine previously come out with a new design of 2,000 h.p. and have it in service within five years? Of course, we shall soon know, but when one thinks of the development put in on the "Sabre," that the "Merlin" was only a larger "Kestrel," and that the first Bristol sleeve valve ran long before we had heard of Hitler, then one wonders for how much experience counts.

It is interesting to know that the rated altitude of the Ford engine is 32,500ft.—but has this been found in flight?

Now one other thing I must protest about. I cannot see the power unit of the future fighter, even in 1945, weighing 4,200lb. (bare) and developing 4,800 b.h.p. In a year's time we shall have some idea of the success of the latest-type fighter—the type with the 2,000 b.h.p. motor. Up to now we have fought with 1,300 b.h.p. or thereabouts in an aircraft weighing approximately 6,500lb. Due to supercharger development and the use of higher boost pressures, considerable increases in speed and additions to armament have been possible. Just how much faster are the 2,000 h.p. types going to be? Their motors, with full equipment (cowl, exhaust, etc.), will probably weigh nearly 4,000lb., pushing the aircraft up to 8,000 or 9,000lb., allowing for increased armament, armour, fuel tanks, etc.

This means a larger aircraft and corresponding loss of speed and manœuvrability. The larger engine is the motive power of a very vicious circle! Well, my guess is a gain in speed, at the same operational height, of from 15 to 20 m.p.h., and the factor that makes it worth while, in the face of the added intricacy and loss of manœuvrability, is undoubtedly the increased weight of fire, the necessity for which is urgent.

However, I think with horror of a fighter with an engine weighing (bare) 4,200lb.; the engine and equipment alone would scale more than a Spitfire!

What we really want is increased power from the same bore and stroke and weight—that's progress. Building a larger engine is just the same as hitching on another horse—it invariably costs more, relatively, than the original, due to increased organisation required. It is only done because there is no alternative. In this war we are unavoidably carrying on the bad habit taught us in the last—bigger engines at all costs, better engines if there is time. R. P. G. J.

Service Aviation

UNITED NATIONS : An American Airacobra fighter squadron shares an airfield in Iceland with a Hudson-equipped squadron of R.A.F. Coastal Command.

Royal Air Force and Fleet Air Arm News and Announcements

THE KING has been graciously pleased to approve the following awards in recognition of gallantry displayed in flying operations against the enemy:—

DISTINGUISHED FLYING CROSS.

P/O. I. M. DAVIES, No. 82 Sqn.
Act. F/O. C. J. LOFTHOUSE, R.A.F.V.R., No. 149 Sqn.

One night in April, 1942, this officer was the captain of an aircraft which carried out an attack on the Heinkel Works at Rostock. Whilst flying over the objective at 10,000 feet his aircraft was held in the beams of searchlights and subjected to intense fire from the defences. Nevertheless, F/O. Lofthouse flew over the works and made his bombing run at 6,000 feet. As the bomb doors failed to open, he made another circuit and, opening the bomb doors manually, released his bombs at 4,900 feet, obtaining hits on the objective. Throughout the attack this officer showed great courage and determination in the face of continuous enemy fire. He has completed many operational sorties with skill and determination.

P/O. E. G. D. JARMAN, R.A.A.F., No. 75 (N.Z.) Sqn.—One night in April, 1942, this officer was the captain of an aircraft detailed to attack Cologne. Whilst over the target area the aircraft was hit by shell fire and sustained damage. The navigator, wireless operator and the front gunner were injured, but, despite this, P/O. Jarman flew on to make his attack. On the return journey it was discovered that a bomb had not fallen owing to the damage caused by the enemy's shell fire, whereupon P/O. Jarman altered course and headed for the North Sea so that the bomb could be jettisoned. Before reaching the sea, however, his aircraft was subjected to an attack by an enemy fighter, whose fire killed the rear gunner, wounded the second pilot, and inflicted further damage to the aircraft. Skilfully controlling his bomber, P/O. Jarman continued his fight and, after jettisoning the bomb into the sea, he finally reached this country, where he made a safe landing with the under-carriage retracted. In the face of extremely harassing circumstances this officer displayed great coolness, courage and determination. He has completed numerous sorties wherein heavily defended targets have been attacked.

P/O. P. J. LAMASON, R.N.Z.A.F., No. 218 Sqn.—One night in April, 1942, this officer was the captain of an aircraft which attacked Pilsen. During the return flight his aircraft was attacked by an enemy fighter and sustained damage; the hydraulics were shot away and the turret rendered unserviceable, while a fire broke out in the middle of the fuselage. Displaying great presence of mind, P/O. Lamason coolly directed his crew in the emergency, and, while two of them dealt with the fire, he skilfully outmanœuvred his attacker and finally shook him off. By his fine airmanship and great devotion to duty, P/O. Lamason was undoubtedly responsible for the safe return of the aircraft and its crew. This officer has completed 21 sorties, and he has at all times displayed courage and ability.

P/O. D. O. MACDOUGALL, R.A.F.V.R.—This officer has completed numerous sorties against the enemy, and he invariably presses home his attacks with the utmost vigour. One night in February, 1942, he played an important part in a successful attack in the Mediterranean on an enemy naval force consisting of cruisers and destroyers. P/O. MacDougall has proved himself to be an exceptionally skilful pilot and captain.

Air Marshal Arthur Travers Harris, A.O.C. in C. Bomber Command, with his chiefs of staff——Air Vice Marshal R. H. M. S. Saundby (centre) and Air Vice Marshal R. Graham (left).

SERVICE AVIATION

He has undertaken many difficult tasks, and, despite bad weather on numerous occasions, he has always completed them. This officer has set a most praiseworthy example.

P/O. J. B. NIVEN, R.A.F.V.R., No. 602 Sqn.—This officer has taken part in 70 operational sorties, and he has destroyed two and probably destroyed a further two hostile aircraft. He has displayed ability and courage, setting a fine example to his fellow pilots.

Flt. Lt. I. N. MACDOUGALL, No. 260 Sqn.—This officer has been engaged on operational flying since October, 1939, and took part in numerous sorties, both by day and by night, whilst operating from this country. In the Middle East, he has performed much valuable work, leading his flight and sometimes the squadron with great skill and zeal on low level machine-gunning attacks. Throughout, he has displayed tremendous keenness and set a high standard. His great powers of leadership have been outstanding.

Act. Sqn. Ldr. J. F. CASTLE, R.A.F.V.R., No. 226 Sqn.—In April, 1942, this officer was the leader of a bomber force which attacked the Power Station at Le Havre. Over the target area, heavy and concentrated anti-aircraft fire was encountered, but Sqn. Ldr. Castle, without deviating from his course, led his formation deliberately through the barrage to make an attack on the objective, on which several hits were obtained; hits were also obtained on the dock gates and on barges. Much of the success achieved can be attributed to the masterly leadership and courage displayed by Sqn. Ldr. Castle. He has completed many sorties, including a low level attack on the Matford Works at Poissy.

Flt. Lt. R. R. SANDFORD, No. 44 (Rhodesia) Sqn. (since reported missing after the Augsburg raid in which he led a section of Lancasters).—In April, 1942, this officer captained an aircraft which attacked Essen. Despite unfavourable weather, Flt. Lt. Sandford skilfully reached the target and, in the face of intense enemy fire, he carried out a determined and courageous attack. This officer has completed a large number of operational missions and he has always displayed exceptional ability and devotion to duty.

Flt. Lt. J. F. WILLS, R.A.F.V.R., No. 156 Sqn.—One night in April, 1942, this officer was the pilot of an aircraft detailed to attack Cologne. Whilst over the target area the aircraft was hit by shell fire, causing a photographic flash to explode which completely denuded the air frame of fabric from the main plane to the rear turret. Other damage was sustained and the aircraft was forced down to a height of only 500 feet.

Nevertheless Flt. Lt. Wills, athough deprived of wireless aid, decided to make the attempt to reach this country. During the return journey his aircraft repeatedly came under fire from the ground defences but, displaying great perseverance and courage, he succeeded in flying the damaged aircraft to England and eventually made a safe landing with the undercarriage retracted. This officer has completed over thirty operational missions and has displayed persistent determination and outstanding courage.

Lt. H. H. SMITHERS, S.A.A.F.—This officer has completed many missions deep into enemy territory. He has shown great skill and enterprise throughout. He has always displayed great devotion to duty which, combined with his patient and untiring efforts, have made his services invaluable.

P/O E. C. L. CORDY, R.A.F.V.R.—P/O. Cordy has completed many operational missions. Throughout, he has displayed great skill and initiative and he has obtained excellent results.

P/O. F. J. E. ISON, R.A.F.V.R., No. 40 Sqn.—This officer has carried out many sorties over Germany and German-occupied territory, including attacks on Hamburg, Kiel, Bremen, Berlin and Brest. On one occasion, when his aircraft was badly damaged by an enemy fighter, his skill in obtaining bearings without wireless aid enabled his captain to fly the aircraft safely back to this country. From Malta P/O. Ison has carried out sorties against targets in Italy and Libya. He has proved a trustworthy and resourceful wireless operator, who has set a high standard of efficiency.

W/O. J. C. GREHAN, No. 148 Sqn.—W/O. Grehan's navigational work has been of the hightst standard. He has carried out a large number of sorties, many of them of a hazardous nature. Throughout, W/O. Grehan has displayed great courage and determination.

DISTINGUISHED FLYING MEDAL.

Flt. Sgt. O. L. HAWES, No. 38 Sqn.—This airman has taken part in many sorties, including attacks on targets in Germany, southern Italy and Libya. In September, 1941, he captained an aircraft which attacked an escorted convoy in the Mediterranean. He carried out a low-level attack on the largest merchant vessel obtaining two hits. He then attacked another merchant vessel, scoring five hits, which set it on fire, and the glare from the flames assisted other aircraft of the squadron to the target. This airman has invariably displayed great courage and determination.

Flt. Sgt. A. MOSES, No. 69 Sqn.—This airman has taken part in raids over Norway, Germany and enemy-occupied territory in France, as well as in the Middle East. Throughout his operational career, Flt. Sgt. Moses has displayed the highest standard of efficiency and determination. His cool judgment has, on many occasions, enabled his pilot to outmanœuvre enemy fighters. He has completed over 120 sorties.

Flt. Sgt. G. C. TWEEDIE, R.A.F.V.R., No. 37 Sqn.—This airman has proved himself to be an excellent captain of aircraft. He has participated in raids on targets in the Dodecanese, Cyrenaica, Syria and Greece. On one occasion his bombs scored hits on an ammunition ship, causing it to blow up. The force of the explosion caused a breach in one of the harbour moles.

Flt. Sgt. G. WILLIAMS, A.A.F., No. 104 Sqn.—This air gunner has taken part in many operational sorties. His devotion to duty is such that he has often volunteered to undertake sorties in the place of air gunners who have been sick. On one of these occasions he shot down an enemy fighter which attempted to attack his aircraft after it had been damaged by anti-aircraft fire.

In an attack on Brest, in daylight, Flt. Sgt. Williams rendered valuable assistance to his formation leader by giving accurate directions to evade numberous enemy fighters. Throughout his operational career this airman has displayed a high standard of morale. He has rendered excellent service to his squadron gunnery leader.

Flt. Sgt. H. J. F. KERR, R.C.A.F., No. 149 Sqn.—One night in April, 1942, this airman was the rear gunner of an aircraft detailed to attack the Heinkel Works at Rostock. After leaving the target area his aircraft was suddenly attacked by an enemy fighter whose pilot opened fire from close range. As the attacker broke away, Flt. Sgt. Kerr delivered an accurate burst of fire, causing the enemy aircraft to waver and then dive sharply. It was then observed to catch fire, and finally it exploded with a bright flash. By his great coolness and efficiency this airman contributed materially to the safe return of his aircraft. Flt. Sgt. Kerr has participated in numerous sorties, and he has always set an excellent example.

Flt. Sgt. I. J. MCLACHLAN, R.N.Z.A.F., No. 75 (N.Z.) Sqn.—One night in April, 1942, this airman was the captain of an aircraft which attacked Cologne. On the return journey, whilst still over hostile territory, his aircraft was suddenly attacked by an enemy fighter whose machine-gun fire killed the second pilot and wounded the rear gunner. The aircraft was extensively damaged (including the hydraulic system), causing the undercarriage and flaps to drop; both gun turrets were rendered unserviceable, and the aircraft became difficult to control. Undaunted, Flt. Sgt. McLachlan flew on, and finally reached this country, where he landed his damaged aircraft safely. This airman has completed numerous sorties, many of which have been against important targets, and he has always shown a high standard of efficiency, skill and resource.

Sgt. C. J. du PREEZ, R.A.F.V.R., No. 15 Sqn.—One night in April, 1942, this airman was the rear gunner of an aircraft which attacked Hamburg. On the return journey his aircraft was engaged by an enemy fighter. Sgt. du Preez was seriously wounded in the neck, the wound being some 6 inches long and so deep that the jugular vein was exposed. Gallantly remaining at his post, this airman continued to use his guns, repelling subsequent attacks until he was rendered unconscious by a bullet which grazed his scalp. Throughout, Sgt. du Preez displayed great devotion to duty and, although so seriously injured, he contributed materially to the safe return of his aircraft.

IT'S NOT CRICKET: A bodyline study on the station cricket pitch.

The flight engineer at the control panel of a Handley Page Halifax.

Sqn. Ldr. Owen Mase, the first officer of the newly formed R.A.F. Regiment to be decorated. He has been awarded the O.B.E.

SERVICE AVIATION

THE KING has been graciously pleased to approve the following award in recognition of brave conduct in successful combined operations against the enemy at Bruneval:—

MILITARY MEDAL.

Flt. Sgt. C. W. H. COX.

Roll of Honour

Casualty Communiqué No. 131.

THE Air Ministry regret to announce the following casualties on various dates. The next of kin have been informed. Casualties reported "in Action" are due to flying operations against the enemy; "on active service" include ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Royal Air Force

KILLED IN ACTION.—Sgt. W. Cansick; P/O. T. G. G. Chater; Sgt. R. E. Dixon; P/O. E. V. D. Kuhle.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Act. Flt. Lt. R. A. Jarvis; Sgt. E. K. McAdam; Flt. Sgt. T. E. Stepney.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. T. Armstrong; Sgt. W. R. Balls; Sgt. R. A. Banks; Flt. Sgt. J. Bendall; Sgt. P. M. Bennett; P/O. W. R. Bloyce; Sgt. B. A. J. Boyse; Flt. Sgt. A. Brown; Sgt. D. A. Butterfield; Sgt. R. K. Clarke; Sgt. J. R. Cook; Sgt. G. A. Crowther; Sgt. P. J. Duffy; Sgt. D. F. Dunlop; Sgt. E. V. Durham; P/O. C. M. Elgar; Sgt. E. S. Elmes; Flt. Sgt. I. N. Forsyth; P/O. C. G. Gilmore; P/O. P. F. R. Graham; Act. Flt. Lt. D. G. Gribble, D.F.C.; Sgt. J. Halls; Sgt. R. Hamilton; Sgt. C. H. Hill; Sgt. F. Holt; Sgt. A. Kettlewell; Sgt. A. W. Kirby; Sgt. A. S. Macdonald; Sgt. M. W. S. McVety; Sgt. R. Marshall; Flt. Lt. J. C. Martin; Sgt. J. E. Mylchreest; Sgt. R. A. Overson; Flt. Sgt. B. Palmer; P/O. D. L. Petrie; Sgt. C. C. Procter; Sgt. W. Raine; Sgt. J. S. Ramsay; Sgt. G. L. Solman; Sgt. H. E. Temple; Sgt. P. Thacker; Sgt. K. A. Tomlinson; Sgt. E. Trott; Sgt. A. W. Vernon; Act. Sqn. Ldr. M. W. Waddington; Sgt. C. E. Wagon; Sgt. T. Whalley; Sgt. R. J. S. Wicks; Sgt. E. A. C. Williams.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Sqn. Ldr. W. A. A. de Freitas; P/O. J. M. Fisher.

WOUNDED OR INJURED IN ACTION.—Sgt. W. H. Bond; Sgt. A. J. Macaskill.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—P/O. K. Lloyd; P/O. A. E. Lockwood.

PREVIOUSLY REPORTED WOUNDED OR INJURED IN ACTION, NOW REPORTED DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Flt. Sgt. T. H. Bigmore.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. G. B. Daines; Sgt. L. F. R. Davis; Sgt. A. C. J. Delehaunt; Sqn. Ldr. K. C. V. D. Dundas, D.F.C.; Sgt. P. H. Foster; Flt. Sgt. H. A. Goldsmith; Sgt. R. W. Hunt; Sgt. T. E. Jordan; P/O. D. J. Morris; Sgt. E. Rose; Sgt. T. J. Sherriff; P/O. R. E. Smaridge; Sgt. S. N. N. O. L. B. Smart; Sgt. G. R. Williams; Sgt. J. A. Wilson.

MISSING.—Sgt. E. R. H. Anderson; Sgt. H. W. Blackmore; P/O. J. C. Boyers; F/O. H. P. Brancker, D.F.C. and bar; Sgt. J. H. Broadhead; Sgt. R. B. Burrows; P/O. P. N. Cann; Sgt. T. K. Carter; P/O. I. McK. Cassavetti; Sgt. W. B. Cattrall; P/O. C. S. Churchill; Sgt. W. Clezy; Sgt. H. S. G. Cullen; Sgt. R. Dawson; Sgt. H. Dracass; Flt. Lt. R. J. Dunlop-Mackenzie; Sgt. J. E. Durrant; P/O. J. R. Feirn; Sgt. H. H. Fetherston; Flt. Sgt. E. M. Ford; Flt. Sgt. C. H. Gray, D.F.M.; Sgt. B. W. Hammersly; P/O. W. G. F. Hawkins; Act. Flt. Lt. T. R. Hawthorn; Sgt. K. Hill; Sgt. D. A. B. Hume; Act. Wing Cdr. J. F. G. Jenkins, D.S.O., D.F.C.; Sgt. E. C. Johnson; Sqn. Ldr. P. J. R. Kitchin; Sgt. O. H. Leggett; Sgt. W. G. McDonald; Flt. Sgt. J. R. H. Main; Sgt. J. Mitchell; Sgt. R. H. D. Morgan; Sgt. J. Oldknow; P/O. F. N. Pope; Sgt. A. S. Ratcliffe; Sgt. F. A. Robinson; Sgt. W. E. Smith; Sgt. J. J. Stewart; Sgt. A. D. Walker; Sgt. E. F. Welfare; Sgt. W. D. Welham; P/O. C. E. White; Act. Flt. Lt. M. White.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—P/O. D. MacG. Brown.

KILLED ON ACTIVE SERVICE.—L.A/C. J. W. F. Allan; Sgt. W. Brand; P/O. J. H. Braybrooks; Sgt. L. S. Collins; Sgt. R. W. Cox; Sgt. G. W. Dawson; Sgt. T. E. Dutton; P/O. J. H. Hackett; P/O. C. Harrison; A/C.1 G. H. Horn; Flt. Sgt. B. Johnson, D.F.M.; Sgt. D. J. Levy; Sgt. S. A. Lingard; Sgt. G. H. F. McClay; Flt. Sgt. W. M. Mason; P/O. F. Massey; Sgt. T. C. Massey; L.A/C. F. F. E. Newland; Sgt. F. L. Podbury; A/C.1 F. Ryan; Sqn. Ldr. B. T. Scott; A/C.2 E. J. B. Smith; Sgt. A. C. Thompson; Flt. Sgt. E. L. Tiley; Flt. Sgt. J. G. Turner; Act. Flt. Lt. A. A. V. Waterfield; Sgt. D. A. Wood; Sgt. J. H. Young.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—A/C.1 D. A. McLeish.

PREVIOUSLY REPORTED MISSING NOW PRE-

RED STAR N.A.A.F.I.: Handing out hot coffee to Russian pilots from a travelling canteen.

The dining hall in a training establishment for W.A.A.F. officers.

SERVICE AVIATION

SUMED KILLED ON ACTIVE SERVICE.—Sgt. A. J. G. Bull; Sgt. J. Smith; Sgt. W. K. Willcox.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW REPORTED KILLED ON ACTIVE SERVICE.—Flt. Sgt. D. Thomas.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. R. W. Newman; P/O. R. C. Wescombe.

DIED ON ACTIVE SERVICE.—Sgt. W. Anderson; A/C.2 T. E. Bray; P/O. A. Calderwood; Flt. Lt. P. T. Carden, M.C.; A/C.2 J. F. Harpin; A/C.2 A. L. Hepburn; L.A/C. R. McDonald; W/O. W. S. McNaughton; L.A/C. J. T. Martin; A/C.2 J. Maxwell; A/C.2 W. D. Moodie; A/C.2 H. V. Pardow; A/C.2 H. Pask; A/C.2 J. Roberts; A/C.2 J. P. Seaman; A/C.1 E. G. Sherrin; Flt. Sgt. F. H. Wakeling; A/C.2 E. Williams; L.A/C. V. J. Williams; A/C.1 T. Wilson.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. T. Bell; A/C.1 F. Burn; Flt. Sgt. J. G. Crossley; Sgt. H. E. Graham; Sgt. K. T. Jackson; Sgt. R. Jefferson; L.A/C. E. C. Turner; Sgt. R. H. Wattam

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/CW.2 M. G. Andrews; Assist. S/O. E. M. Burrows; L.A/CW. H. Burton; L.A/CW. E. Cassidy; L.A/CW. I. Comley; L.A/CW. I. T. Tracey.

Royal Australian Air Force

KILLED IN ACTION.—P/O. A. C. Johnson; Flt. Lt. S. F. Lee; P/O. G. D. Macpherson; Sgt. H. W. T. Sloman; Sgt. L. T. Watson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. N. Tweedie.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW REPORTED KILLED IN ACTION.—Sgt. L. M. Readett.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. W. F. Anderson; P/O. L. W. Bailey; Sgt. A. T. Bott; Sgt. G. Gormall; Sgt. R. K. Grimley; Sgt. H. J. Lammond; Sgt. S. Menzies; Sgt. G. Parker; Sgt. G. Steele; Sgt. N. Tynan.

MISSING.—Sgt. T. Essam; Sgt. P. Field; Sgt. J. C. Hannaford.

KILLED ON ACTIVE SERVICE.—Sgt. F. M. Donohoe.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED ON ACTIVE SERVICE.—Sgt. J. T. Small; Sgt. W. R. Wheeler.

Royal Canadian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. L. C. Bentley; Sgt. D. S. Fisk; P/O. J. A. Small; Sgt. F. W. Wade.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. D. J. Carmichael; Sgt. H. R. Crowe; Sgt. H. E. Fear.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. J. M. Thompson.

MISSING.—P/O. J. F. Chevalier; Sgt. W. R. Groff; Flt. Sgt. W. M. Popplestone; Sgt. L. O. Stalker; Sgt. A. F. Williams.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. H. R. Hatfield; Act. F/O. W. L. Mackay.

KILLED ON ACTIVE SERVICE.—P/O. F. B. Cobb; P/O. J. R. Hebert; Sgt. J. R. Keith; Sgt. R. W. Leach; Sgt. A. T. Murtha; Sgt. W. W. Smith; Sgt. W. A. Walker.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—P/O. C. K. Bowen; Sgt. J. G. A. Richards.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. C. W. Cudmore.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. J. C. McK. Gibson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. G. I. Harrowby; Sgt. S. G. Shirley-Thompson.

MISSING, BELIEVED KILLED IN ACTION.—Sqn. Ldr. R. R. Stewart.

MISSING.—Flt. Sgt. L. M. Chamberlain; P/O. W. J. Parton.

KILLED ON ACTIVE SERVICE.—Sgt. S. H. Robinson.

South African Air Force

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Air Sgt. G. C. Green.

WOUNDED OR INJURED IN ACTION.—Air Sgt. R. E. M. Hague; Lt.-Col. A. J. Mossop; Flt. Sgt. R. G. Van Eyssen.

MISSING.—Lt. J. M. W. Egner.

DIED ON ACTIVE SERVICE.—Air Mech. V. J. J. Hay.

Indian Air Force

KILLED ON ACTIVE SERVICE.—F/O. Man Mohan Singh.

Casualty Communiqué, No. 132.

Royal Air Force

KILLED IN ACTION.—Sgt. L. Johnson; P/O. R. W. M. Moon; Sgt. K. W. Stevenson.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. C. T. R. Anderson; Sgt. E. S. Briggs; Sgt. J. Butterworth; Sgt. A. V. Carpenter; Sgt. W. R. Cheesman; Sgt. J. S. Dainton; Sqn. Ldr. P. G. S. Dickenson; Sgt. M. Gill; Sgt. A. Gilmour; Sgt. J. R. Griffiths; Sgt. J. A. Groom; Sgt. J. G. Hanlin; Sgt. L. Harding; Sgt. S. Jamieson; Sgt. T. Kelly; Sgt. W. J. Lewis; Sgt. J. H. Lucking; Sgt. J. E. Medhurst; Sgt. B. N. B. Orr; Sgt. R. I. Rhodes; Sgt. J. S. Saunders; Sgt. R. A. Scott; Act. Flt. Lt. R. P. Stevens, D.S.O., D.F.C.; Sgt. K. E. Stewart; Sgt. A. Stockdale; Flt. Sgt. F. Sumner; Sgt. P. A. Taylor; Sgt. A. B. Thomas; Sgt. J. Towns; Flt. Sgt. E. Twelves; Sqn. Ldr. J. G. Walker; Sqn. Ldr. C. A. Wood; Sgt. M. C. Young.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. E. O. Adams; Flt. Sgt. R. Atkin; A/C.1 A. C. Attwood; Sgt. G. E. Bagshaw; Sgt. W. L. Ball; Sgt. L. H. Barraclough; Flt. Sgt. W. E. Barrett; Sgt. R. E. Bates; Sgt. J. C. Beardmore; Sgt. W. Bearne; Sgt. E. P. Beckwith; P/O. R. F. Bennett; P/O. H. R. Bentley; Flt. Sgt. K. G. Betts; Sgt. J. R. Boland; Sgt. R. H. Breckell; Flt. Sgt. A. Brown; Sgt. J. Bruckshaw; P/O. G. W. Bull; P/O. A. Carey-Hill; F/O. A. W. L. Cobbe; Sgt. R. Davies; Sgt. D. M. V. P. Devereux; Sgt. K. G. Edis; F/O. A. G. Evill; Sgt. M. E. Farnan; Flt. Sgt. E. W. W. Gange; Sgt. R. G. Gove; Sgt. W. A. Gray; Sgt. P. R. Griffin; Sgt. J. W. Hallam; Flt. Sgt. W. P. J. Hancox; Sgt. A. C. F. Harrop; Flt. Sgt. T. H. Harrower; F/O. A. M. Harvey; Sgt. S. A. Harvey; Sgt. D. G. Hodge; Sgt. J. L. Holloway; Sgt. J. Horabin; F/O. M. Jacoby; P/O. J. E. Johnson; Sgt. P. S. D. Johnston; Sgt. G. A. Jupp; Sgt. J. H. Keen; Sgt. L. W. Ketteringham; Sgt. J. A. C. King; Sgt. V. F. D. Kirk; Flt. Sgt. W. S. Kitson, D.F.M.; Sgt. R. M. Knapman; P/O. E. J. Lamb; Sgt. W. D. Lambert; P/O. W. E. Law; Sgt. J. W. Lee; P/O. M. Lee; Sqn. Ldr. H. F. McCullagh; Sgt. W. J. Moss; Sgt. A. R. McElden; P/O. R. H. McGlashan; Sgt. J. A. McLean; Sgt. J. F. E. Maltby; Flt. Sgt. B. Martin; Sgt. G. H. Mayor; Sgt. A. J. R. Millard-Tucker; L.A/C. H. Mills; Sgt. R. M. Minchin; Sgt. K. E. Newman; P/O. J. A. Nutt; Sgt. J. R. Palmer; Flt. Sgt. J. Parkin; Sgt. J. M. Pattison; Sgt. A. P. Perry-Keene; Flt. Sgt. J. E. Phillips; F/O. A. L. Pullen; P/O. C. D. Ramsay; Sgt. E. J. Richards; L.A/C. J. F. Richard; Sgt. G. A. Robbins; Sgt. F. H. Sanders; Sgt. E. R. Schofield; P/O. F. W. Selfe; F/O. D. Shaw; Sgt. D. R. Sherwin; Sgt. D. Sills; Sgt. J. M. Simmons; Sgt. A. E. Simpkin; Sgt. R. B. Strachan; Sgt. J. F. Tarran; L.A/C. F. Teasdale; Sgt. C. D. Thomas; F/O. E. Q. Tobin; Sgt. S. C. Tottle; Flt. Sgt. E. D. Tyler; Act. Sqn. Ldr. T. J. S. Warren, D.F.C.; Act. F/O. J. T. Waterfall; Sgt. H. P. S. White; Sgt. R. J. White; Sgt. J. L. Whitticase; A/C.1 G. A. Widdowson; Sgt. G. W. T. Wiggs; Sgt. P. B. H. Wildgoose; P/O. T. McS. Wilson; Sgt. W. J. Young.

WOUNDED OR INJURED IN ACTION.—Sgt. G. W. Herring; F/O. N. W. Lee.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—L.A/C. G. E. Boorman; Sgt. K. W. McCaskill.

MISSING.—P/O. H. S. Brough; Sgt. C. Brown; Sgt. J. Burns; Sgt. E. A. Cobham; Sgt. A. Currie; P/O. R. J. Cussen; Flt. Sgt. E. R. Dimond; Sgt. J. W. G. Foreshaw; Sgt. B. H. Forster; Sgt. F. A. Fry; Sgt. H. Gatiss; Sgt. G. Giles; Sgt. J. T. C. Hazledine; Flt. Sgt. B. M. S. Henderson; Sgt. F. H. W. Hoadley; A/C.1 J. W. Hooper; Sgt. R. F. Howell; Flt. Sgt. N. D. Lenton; Flt. Sgt. R. T. Linden; Sgt. D. McDonald; Flt. Sgt. M. McLean; P/O. G. J. Maygothling; Sgt. R. Moffitt; Flt. Sgt. G. E. H. Obott; Flt. Lt. R. H. Page; A/C.1 F. W. Palmer; Sgt. E. F. Penlington; Sgt. W. H. Peters; Sgt. H. L. Price; L.A/C. R. F. Rendell; Sgt. J. S. Ross; Sgt. P. D. Ryan; P/O. B. E. P. Sadler; Flt. Sgt. J. Seery; Sgt. H. Selby; Sgt. R. G. Simpson; Sgt. D. Swaine; P/O. J. N. Tillard; Sgt. P. R. Tomkin; Sgt. D. Towler; Flt. Sgt. R. A. Walker; Sgt. M. V. Ward; Sgt. W. L. Woodford.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—A/C.2 W. F. Laurence; A/C.2 W. Richardson; A/C.1 N. W. Saunders.

KILLED ON ACTIVE SERVICE.—Sgt. J. Amphlett; Flt. Lt. P. A. Kimpton; Sgt. W. E. Lloyd; Sgt. J. McCarley; Sgt. W. Mankelow; L.A/C. R. W. Maxwell; L.A/C. D. W. Turner.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. E. Firth; F/O. J. A. Hutton; Cpl. E. R. Jones; Sgt. S. C. R. Pozzi; P/O. F. D. M. Sloan.

DIED ON ACTIVE SERVICE.—L.A/C. D. A. Janes; A/C.2 S. Jones; L.A/C. P. W. E. Miller; Act. Flt. Lt. A. I. Orr-Ewing; A/C.2 K. W. Palmer; A/C.2 J. J. Roberts

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—A/C.1 H. J. Best; Sgt. R. W. Girdham; Sgt. B. J. L. Lilly.

L.A.C. Weston at work on a painting which he entered for the exhibition of painting by members of the R.A.F. Balloon Command.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/CW.2 D. Cuthbertson.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. W. E. Hearle.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Act. F/O. R. B. Campbell; Sgt. J. F. Cash; Sgt. R. Johnston; Act. F/O. S. D. Marshall.

MISSING.—Sgt. F. G. Bower; Sgt. F. J. Cassells; F/O. J. W. Vickers.

KILLED ON ACTIVE SERVICE.—Sgt. A. H. Hanson; Sgt. R. A. Headlam; Sgt. H. C. Odgers; Sgt. M. C. Taylor.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. J. M. Farrer; Sgt. G. C. Vaudrey.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. W. V. Howey.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. W. M. Chambers; Sgt. C. T. Hasbottle; Sgt. G. P. M. Hardesty; Sgt. R. D. Killis; P/O. D. A. Simpson; Sgt. I. Stein.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Wing Cdr. R. G. Briese; Sgt. G. H. P. Buchanan; Flt. Sgt. S. C. Camp; P/O. J. R. Coleman; Sgt. J. M. Dixon; P/O. J. R. Freeland; Flt. Sgt. A. L. D. Hassan; Sgt. M. McL. Keswick; Flt. Sgt. R. M. McIntyre; Sgt. G. A. McLeod; Sgt. W. R. Malkemus; P/O. M. K. Solheim; Sgt. E. J. Stevenson; Sgt. G. C. Waldern; Flt. Sgt. J. E. Weir.

MISSING.—Flt. Lt. W. B. Brown; P/O. L. J. Convey; Sgt. C. D. Dunn; Sgt. M. D. Gallagher; Sgt. E. J. Graham; Sgt. E. J. F. Paquette; Sgt. R. J. Thompson.

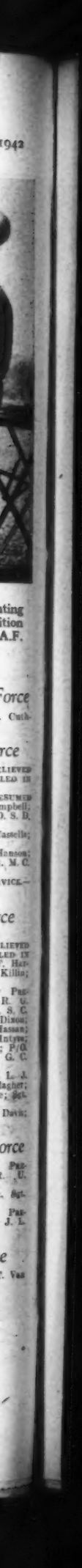
KILLED ON ACTIVE SERVICE.—Sgt. J. A. Davis; Sgt. M. S. Lee.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. R. U. McCracken.

MISSING.—Flt. Sgt. H. C. Russell; Flt. Sgt. W. M. Krebs; Flt. Sgt. R. J. B. Lindesay

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. J. L. McNamara.

South African Air Force

WOUNDED OR INJURED IN ACTION.—Lt. T. Van der Veenu.